SEPARATOR

54-00068

HAZ WASTE

ASSESSMENT

03/21/2001

N/A

9545639

RISK ASSESSMENT

CEDAR CHEMICAL CORPORATION
WEST HELENA, ARKANSAS

EnSafe Project Number:
2162-012

Sections 1-6 and Appendices A, G, J, and K

Prepared for:

Cedar Chemical Corporation
West Helena, Arkansas

Prepared by:

ENSAFE

EnSafe Inc.
5724 Summer Trees Drive
Memphis, Tennessee 38134
(901) 372-7962

March 21, 2001

Table of Contents

List of Figures

List of Appendices

Acronyms and Symbols Frequently Used in This Report

ABS	absorption factor
ADEQ	Arkansas Department of Environmental Quality
AF	adherence factor
ARAR	applicable or relevant and appropriate requirement
AT	averaging time
bgs	below ground surface
BW	body weight
C_w	concentration in water
CCC	Cedar Chemical Corporation
CF	conversion factor
cm^2	square centimeters
COC	chemical of concern
COPC	chemical of potential concern
CR	cancer risk
CRAVE	Carcinogen Risk Assessment Verification Endeavor
CT	central tendency
dC/dt	change in VOC concentration over time
DI	daily intake
ECPC	ecological chemical of potential concern
ED	exposure duration
EF	exposure frequency
EPC	exposure point concentration
ERA	ecological risk assessment
ER-L	effects range-low
ET	exposure time
H_c	Henry's law constant
HEAST	Health Effects Assessment Summary Tables
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
IRIS	Integrated Risk Information System
kg	kilogram
kg/L	kilogram per liter
KR	contact rate

L/day	liter per day
MCL	maximum contaminant level
m	meter
m/sec	meter per second
μg/kg	micrograms per kilogram
μg/L	micrograms per liter
μg/mg	micrograms per milligram
mg/day	milligrams per day
mg/kg	milligram per kilogram
mg/L	milligrams per liter
mg/m^3	milligrams per cubic meter
m^3/day	cubic meters per day
MSSL	medium-specific screening level
MTCA	Model Toxic Control Act
m^2/sec	square meters per second
mm	millimeters
moles/ft^2-lb	moles per square feet pound
N	number of samples
N_A	molar flux
N/A	not applicable
NOAEL	no observed adverse effects level
NPDES	National Pollution Discharge Elimination System
OSWER	Office of Solid Waste and Emergency Response
P	total pressure
p_A	partial pressure
$(p_b)_{lm}$	log mean of air pressure
ppb	parts per billion
ppm	parts per million
PQL	practical quantitation limit
psi	pounds per square inch
P_{vp}	air vapor pressure
RAGS	Risk Assessment Guidance for Superfund
RCRA	Resource Conservation and Recovery Act
RfC	reference concentration
RfD	reference dose
RFI	RCRA Facility Investigation
RGO	remedial goal option
RME	reasonable maximum exposure

SF	slope factor
SQB	sediment quality benchmark
SQC	sediment quality criteria
SQL	sample quantitation limit
SSL	soil screening level
SSV	sediment screening value
SWMU	solid waste management unit
UCL	upper confidence limit
USEPA	United States Environmental Protection Agency
VF	volatilization factor
VOC	volatile organic compound

EXECUTIVE SUMMARY

This report presents results of the baseline human health risk assessment (HHRA) and ecological risk assessment conducted for the Cedar Chemical Corporation (CCC) facility in West Helena, Arkansas. The objective of the site-specific risk assessment was to evaluate any potential impacts to human health and the environment associated with chemicals that have been detected in soil, sediment, and groundwater at the site.

This baseline risk assessment is divided into two parts — one addressing human health risk, and the other assessing ecological risk.

Site History

CCC is an active chemical manufacturing facility in Phillips County, Arkansas, south of West Helena, Arkansas. The site consists of approximately 48 acres along State Highway 242, one mile southwest of the intersection of U.S. Highway 49 and Highway 242.

Prior to 1970, the CCC plant site was cultivated farmland. In 1970, Helena Chemical Company acquired the site to construct a Propanil manufacturing facility. In 1971, the newly constructed plant was sold to J.A. Williams, who in turn transferred the plant to Eagle River Chemical Corporation, a newly formed Arkansas corporation, which was initially controlled by the Ansul Company. Under Ansul's management, the plant was converted to the production of dinitrobutylphenol, also known as Dinoseb. In late 1972, Ansul sold its majority stock interest in Eagle River Chemical Corporation back to the corporation, leaving J.A. Williams as the sole shareholder. Eagle River Chemical Corporation was subsequently merged into Vertac Chemical Corporation. Vertac operated the plant until CCC acquired the site in 1986.

The facility consists of six production units and support facilities, an office on the north side of Industrial Park Road, and a biological treatment system south of the road. The entire CCC facility is fenced with controlled access. Active processes are conducted on approximately 20 acres. The rest of the site houses the biological treatment ponds and closed surface impoundments, or is unoccupied.

Risk Assessment Summary

For the HHRA, the CCC facility was evaluated based on the eight sites (Sites 1 to 6, 8, and 9) that were defined during the RCRA Facility Investigation (RFI). The sites were grouped based on the exposure setting and chemicals detected.

The overall framework used in this HHRA is based on information presented in the *Risk Assessment Work Plan* (EnSafe, 1998), which follows approved USEPA guidance.

For this HHRA, soil and sediment data were evaluated by site, while groundwater is evaluated separately as either perched groundwater or alluvial groundwater. The list of chemicals detected in site media selected for inclusion in the quantitative human health risk assessment was obtained by: (1) comparison of site-related data to risk-based screening levels or ARARs and (2) comparison to site-related background concentrations, when available.

Chemicals of potential concern (COPCs) identified for soil and sediment at each of the eight sites are presented below.

Site	Surface Soil	Surface and Subsurface Soil	Sediment
Site 1	arsenic, dieldrin, 1,2-dichloroethane	arsenic, dieldrin, 1,2-dichloroethane	arsenic, chromium
Site 2	aldrin, Dinoseb	arsenic, chromium, mercury, aldrin, dieldrin, 1,2-dichloroethane, chloroform, methylene chloride	NS
Site 3	NS	Dinoseb	arsenic, aldrin, dieldrin, toxaphene, pentachlorophenol
Site 4	dieldrin, Dinoseb	arsenic, dieldrin, Dinoseb, 3,4-dichloroaniline, 1,2-dichloroethane	NS
Site 5	NS	There were no COPCs identified.[a]	NS

Site	Surface Soil	Surface and Subsurface Soil	Sediment
Site 6	arsenic, aldrin, dieldrin, methoxychlor, toxaphene, Dinoseb	NS	NS
Site 8	There were no COPCs identified.	NS	NS
Site 9	heptachlor, Dinoseb, 3,4-dichloroaniline, Propanil	arsenic, Dinoseb, 3,4-dichloroaniline, Propanil	NS

Notes:
NS = Not sampled.
All sample depths for Site 5 exceed 10 feet. No receptors contact soil at depths below 10 feet.

COPCs identified for perched groundwater are: arsenic, barium, cadmium, chromium, lead, 4,4'-DDT, alpha-BHC, 2,6-dinitrotoluene, 3,4-dichloroaniline, 4-chloroaniline, bis (2-chloroethyl) ether, Dinoseb, 1,2-dichloroethane, 4-methyl-2-pentanone, acetone, benzene, chloroform, methylene chloride, and trichloroethene.

COPCs identified for alluvial groundwater are: 1,1,2-trichloroethane, 1,2-dichlorobenzene, 1,2-dichloroethane, 1,2-dichloropropane, acetone, benzene, bromodichloromethane, bromoform, chlorobenzene, chloroform, dibromochloromethane, methylene chloride, 4-methyl-2-pentanone, and toluene.

Because chemicals in soil may migrate into the underlying aquifer, maximum detected concentrations in soil were compared to site-specific soil screening levels. Soil screening levels (SSLs) are used to determine the potential for chemicals in soil to migrate to groundwater.

Because SSLs do not address variables such as natural attenuation, the results of this screening are only a general indicator that migration will occur. The screening results indicate that the only chemicals likely to migrate to groundwater are volatile organic compounds (VOCs): 1,2-dichloroethane, bis(2-chloroethyl)ether, chloroform, and methylene chloride. Based on alluvial groundwater data, the only groundwater detections are the VOCs identified. Although the

SSL data indicate that other contaminants may migrate to groundwater, this has not occurred. VOCs in alluvial groundwater will be quantitatively evaluated in the HHRA.

Screening perched groundwater data with SSLs indicates that the contaminant detections that exceed the medium-specific screening level (MSSL) are: 1,2-dichloroethane, alpha-BHC, bis(2-chloroethyl) ether, Dinoseb, chloroform, and methyl chloride. Although the perched groundwater data indicate that chemicals have migrated, these chemicals are not likely to migrate to the alluvial aquifer because the two aquifers are not connected. All chemicals exceeding the SSL and detected in perched groundwater will be quantitatively evaluated in the HHRA.

Risk was evaluated for the following receptors and exposure pathways using guidance provided in *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual* (RAGS Part A) (USEPA, 1989).

Receptors	Medium and Exposure Pathway	Pathway Selected for Evaluation?	Reason for Selection or Exclusion
Current Land Uses			
Site Workers	Air, Inhalation of gaseous contaminants released from soil	Yes	It is assumed that site workers will inhale gaseous contaminants from soil.
	Air, Inhalation of chemicals entrained in fugitive dust	Yes	It is assumed that site workers will inhale fugitive dust.
	Air, Inhalation of gaseous contaminants released from alluvial groundwater	No	Alluvial groundwater is not a water source at CCC.
	Surface Soil, Incidental ingestion	Yes	It is assumed that site workers will ingest incidental amounts of soil.
	Surface Soil, Dermal contact	Yes	It is assumed that site workers will have dermal contact with soil.
Offsite Workers	Air, Inhalation of gaseous contaminants released from alluvial groundwater	No	Alluvial groundwater is not a general or drinking water source at neighboring facilities. Site workers are either not present or within enclosed spaces during irrigation.
Future Land Uses			
Site Workers	Air, Inhalation of gaseous contaminants released from soil	Yes	It is assumed that site workers will inhale gaseous contaminants from soil.
	Air, Inhalation of chemicals entrained in fugitive dust	Yes	It is assumed that site workers will inhale fugitive dust.
	Air, Inhalation of gaseous contaminants released from alluvial groundwater	No	Alluvial groundwater is not a water source at CCC. Site workers at CCC are either not present or within enclosed spaces during irrigation events.
	Surface Soil, Incidental ingestion	Yes	It is assumed that site workers will ingest incidental amounts of soil.

Receptors	Medium and Exposure Pathway	Pathway Selected for Evaluation?	Reason for Selection or Exclusion
Future Land Uses (cont'd)			
Site Workers (cont'd)	Surface Soil, Dermal contact	Yes	It is assumed that site workers will have dermal contact with soil.
Offsite Workers	Air, Inhalation of gaseous contaminants released from alluvial groundwater	No	Alluvial groundwater is not a general or drinking water source at neighboring facilities. Site workers are either not present or within enclosed spaces during irrigation.
Future Onsite Construction Workers	Air, Inhalation of gaseous contaminants released from soil	Yes	It is assumed that construction workers will inhale gaseous contaminants from soil.
	Air, Inhalation of chemicals entrained in fugitive dust	Yes	It is assumed that construction workers will inhale fugitive dust.
	All soil depths, Incidental ingestion	Yes	It is assumed that site workers will ingest incidental amounts of soil.
	All soil depths, Dermal contact	Yes	It is assumed that site workers will have dermal contact with soil.
	Sediment, Incidental ingestion	Yes	It is assumed that site workers will ingest incidental amounts of sediment.
	Sediment, Dermal contact	Yes	It is assumed that site workers will have dermal contact with sediment.
Future Onsite Construction Workers	Perched groundwater, Incidental ingestion	Yes	It is assumed that site workers will ingest incidental amounts of perched groundwater.
	Perched groundwater, Dermal contact	Yes	It is assumed that site workers will have dermal contact with perched groundwater.
Future Offsite Agricultural Workers	Air, Inhalation of gaseous contaminants released from alluvial groundwater	Yes	It is conservatively assumed that farmers may inhale VOCs emanating from alluvial groundwater.
Future Site Trespassers (Adolescents, 7 through 16 years old)	Air, Inhalation of gaseous contaminants released from soil	Yes	It is assumed that trespassers will inhale gaseous contaminants from soil.
	Air, Inhalation of chemicals entrained in fugitive dust	Yes	It is assumed that trespassers will inhale fugitive dust.
	Surface Soil, Incidental ingestion	Yes	It is assumed that trespassers will ingest incidental amounts of soil.
	Surface Soil, Dermal contact	Yes	It is assumed that trespassers will have dermal contact with soil.
	Sediment, Incidental ingestion	Yes	It is assumed that trespassers will ingest incidental amounts of sediment.
	Sediment, Dermal contact	Yes	It is assumed that site workers will have dermal contact with sediment.

Results of Risk Characterization

Except for alluvial groundwater exposure for the offsite agricultural worker, cancer risk for all of the scenarios investigated for perched groundwater, sediment, and soil exposures have cumulative cancer risks for all pathways of less than 1E-04. Offsite worker cancer risks and noncarcinogenic risk for all receptors are discussed in the following sections.

Offsite Agricultural Worker

Groundwater carcinogenic risk for alluvial groundwater is 7E-04. The primary contributors to carcinogenic risk for alluvial groundwater are 1,2-dichloroethane (5E-04) and methylene chloride (2E-04).

Noncarcinogenic risks exceeding unity for the offsite agricultural worker exposure to airborne VOCs are chloroform, 1,2-dichloroethane, and toluene.

Construction Worker

Hazard quotients (HQs) for several sites exceed unity (i.e., greater than 1), suggesting that COPCs may pose adverse noncarcinogenic impact to receptors evaluated in the HHRA. The construction worker soil exposures exceed unity in perched groundwater and at Sites 2, 3, 4, and 9. The primary contributor to the soil HQ is Dinoseb at Sites 3, 4, and 9, 3,4-dichloroaniline at Site 4, and 1,2-dichloroethane at Site 2. 4-Chloroaniline, 3,4-dichloroaniline, 1,2-dichloroethane, and methylene chloride are the primary contributors to HQ for perched groundwater.

Adult Worker

Noncarcinogenic risks exceed unity (i.e., greater than 1) for the adult worker exposed to Dinoseb and Propanil in surface soil at Site 9.

Trespasser

Noncarcinogenic risks with an HQ greater than 1 for the trespasser include Dinoseb and Propanil at Site 9.

Chemicals of Concern Identified by Site and Media

A contaminant was selected as a chemical of concern (COC) if its cancer risk (CR) exceeded 1E-6 or it had an HQ greater than 1. For CCC sites, the COCs are listed below by site and media:

Site	Surface Soil	Subsurface Soil	Sediment
1	None	None	Arsenic
2	None	1,2-Dichloroethane	NA
3	NA	Dinoseb	None
4	None	3,4-Dichloroaniline, Dinoseb	NA
6	None	NA	NA
9	Dinoseb, Propanil	Dinoseb, Propanil	NA
Perched Groundwater		4-Chloroaniline, 3,4-Dichloroaniline, 1,2-Dichloroethane, Methylene chloride	
Alluvial Groundwater		Benzene, Chloroform, Methylene Chloride, 1,2-Dichloroethane, Toluene, 1,1,2-Trichloroethane	

Results of Central Tendency Evaluation

Where reasonable maximum exposure (RME) risk estimates indicated a CR greater than 1E-4 or an HQ greater than 1, central tendency (CT) analyses were performed. The CT analysis uses the arithmetic mean concentration as the EPC and 50th percentile exposure assumptions, consistent with guidance in *Exposure Factor's Handbook* (USEPA, 1997). Central tendency exposures are presented for comparison to risks associated with RME exposure.

A CT evaluation was completed for the following sites, media, and chemicals.

Construction Worker: Noncarcinogenic risks calculated using CT exposure assumptions for the construction worker exposed to surface and subsurface soil are less than 1 at Sites 2, 3, and 9. Noncarcinogenic risks to 3,4-dichloroaniline in perched groundwater and 3,4-dichloroaniline and Dinoseb in surface and subsurface soil at Site 4 are greater than 1.

Adult Worker: Using CT exposure assumptions noncarcinogenic risks for Dinoseb at Site 9 remain greater than 1. No chemicals exhibiting carcinogenic effects exceeded the 1E-04 threshold for this receptor.

Receptor	Site	Media	Chemicals
Construction Worker	1 and 2	Perched Groundwater	4-Chloroaniline, 3,4-Dichloroaniline, 1,2-Dichloroethane, Methylene chloride
	3	Surface and Subsurface Soil	Dinoseb
	4	Surface and Subsurface Soil	3,4-Dichloroaniline, Dinoseb
	9	Surface and Subsurface Soil	Dinoseb, Propanil
Adult Worker	9	Surface Soil	Dinoseb, Propanil
Trespasser	9	Surface Soil	Dinoseb, Propanil
Offsite Agricultural Worker	—	Alluvial Groundwater	Methylene chloride, 1,2-Dichloroethane, Toluene

Trespasser: Using CT exposure assumptions, noncarcinogenic risks are less than 1 for both Dinoseb and Propanil. No chemicals exhibiting carcinogenic effects exceeded the 1E-04 threshold for this receptor.

Offsite Agricultural Worker: Estimated noncarcinogenic risks are less than 1 for the offsite agricultural worker exposed to VOCs released from alluvial groundwater, using CT exposure assumptions. Carcinogenic risk is 3E-05 and the primary contributor to risk is 1,2-dichloroethane. However, the risk of 3E-05 is within the USEPA threshold range.

Conclusions

Alluvial groundwater risks based on RME exposure assumptions for the offsite agricultural worker represent the highest carcinogenic risks to human receptors contacting contaminated media associated with CCC.

Noncarcinogenic risk based on RME for all receptors is substantially high, based primarily on offsite agricultural worker exposure to 1,2-dichloroethane in alluvial groundwater, construction worker exposures to Dinoseb in surface and subsurface soil at Sites 3 and 9, and trespasser and site worker exposure to Dinoseb at Site 9.

For ecological receptors, potential risk in Area I is considered acceptable because these ditches are integral components of the facility's waste water treatment system. Because of the function of these ditches, standing water is frequently drained and any aquatic habitat is considered opportunistic. The isolated wetland in Area II is not considered at risk because the exposure pathway is incomplete. Risk to receptors in Area III from exposure to contaminated alluvial groundwater from irrigation farm practices is considered minimal based on the lack of receptors and the high volatility of 1,2-dichloroethane.

Remedial Goal Options

Remedial goal options (RGOs) are site-specific chemical concentrations used by risk managers during the development of remedial alternatives and are calculated to equate with specific target carcinogenic and noncarcinogenic risk levels. For CCC, RGOs were calculated for chemicals having an incremental lifetime cancer risk greater than 1E-6 or an HQ greater than 1. In accordance with USEPA Region IV Supplemental Guidance (USEPA, 1995a), RGOs were calculated at 1E-6, 1E-5, and 1E-4 risk levels for carcinogenic COCs and HQ levels of 0.1, 1, and 3 for noncarcinogenic COCs for all applicable media. Inclusion in the RGO table does not necessarily indicate that remedial action will be required to address a specific chemical. Instead, RGOs are provided to facilitate risk-management decisions. RGOs for these chemicals are provided in Tables 91 through 97 in Appendix A.

I

1.0 INTRODUCTION

This report presents results of the baseline human health risk assessment (HHRA) and ecological risk assessment (ERA) conducted for the Cedar Chemical Corporation (CCC) facility in West Helena, Arkansas. The objective of the site-specific risk assessment was to evaluate any potential impacts to human health and the environment associated with chemicals that have been detected in soil, sediment, and groundwater at the site.

Site-specific information and sampling results from the following reports have been used in to perform this risk assessment:

- Interim Response Work Plan, Cedar Chemical Corporation, West Helena, Arkansas. EnSafe, 1995b.

- Facility Investigation Cedar Chemical Corporation — FINAL. EnSafe, 1996.

- Risk Assessment Work Plan, Cedar Chemical Corporation. EnSafe, 1998.

- Laboratory results analyzed by Paradigm Analytical Laboratories, Inc. September 1995, October 1995, November 1995, January 1996, April 1996, November 1996, March 1997, July 1997, and August 1997.

- Laboratory results analyzed by IT Corporation. September 1993.

- Laboratory results analyzed by American Interplex November 1994, December 1994, and January 1995.

- Biomonitoring results for Cedar Chemical Corporation by American Interplex calendar year 1998 and 1999.

For ease of use, all tables generated for risk calculation and remedial goal options (RGOs) (i.e., Tables 1 to 97) are presented in Appendix A.

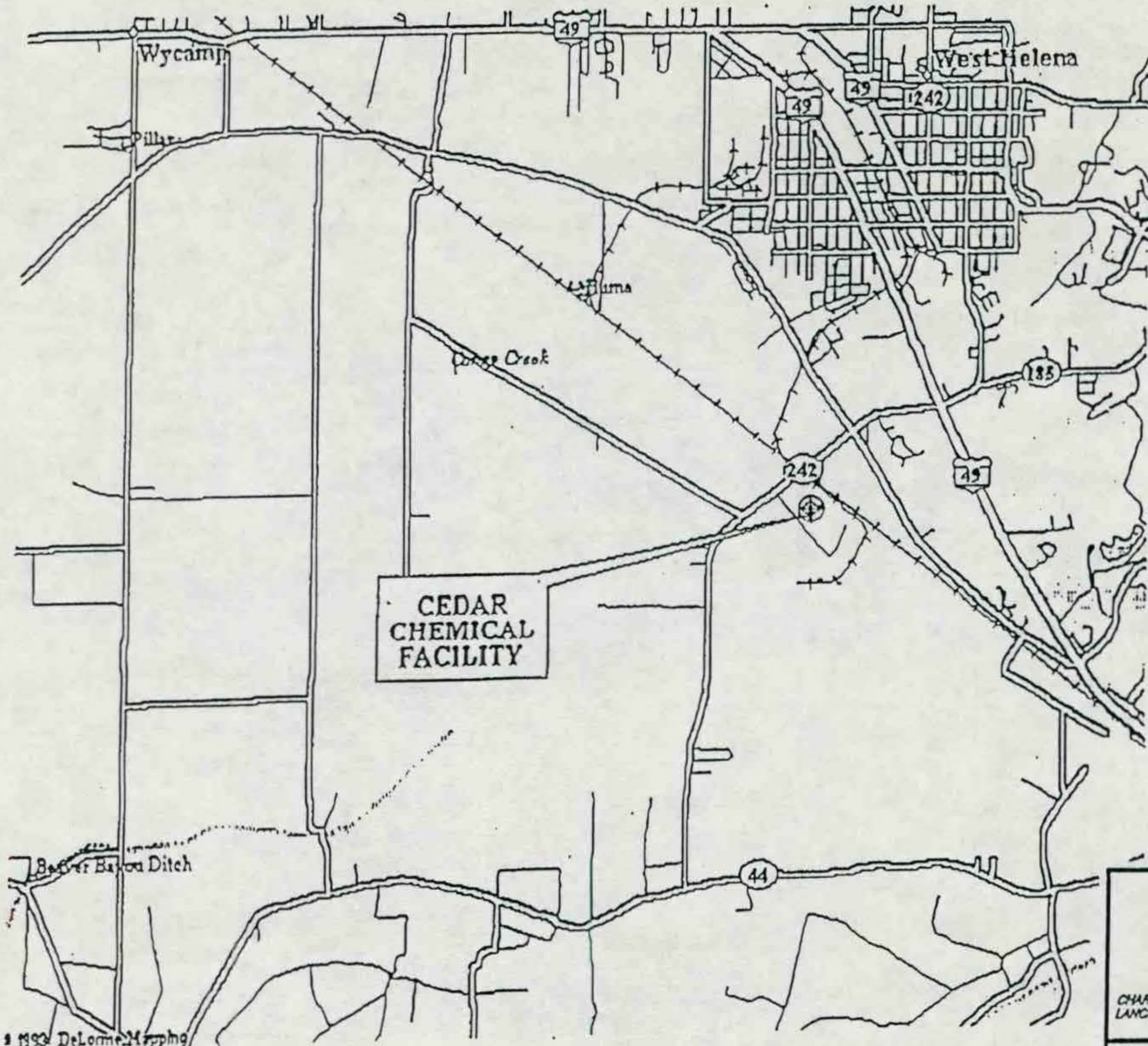
1.1 Site Condition

CCC is an active chemical manufacturing facility in Phillips County, Arkansas, just south of West Helena, Arkansas. The site consists of approximately 48 acres along State Highway 242, one mile southwest of the intersection of U.S. Highway 49 and Highway 242. Figure 1 presents a vicinity map for the site.

CCC consists of six production units and support facilities, an office on the north side of Industrial Park Road, and a biological treatment system south of the road. The entire facility is fenced with controlled access. Active processes are conducted on approximately 20 acres. The rest of the site houses the biological treatment ponds and closed surface impoundments, or is unoccupied.

1.2 Site History

Prior to 1970, the CCC plant site was cultivated farmland. In 1970, Helena Chemical Company acquired the site to construct a Propanil manufacturing facility. In 1971, the newly constructed plant was sold to J.A. Williams, who in turn transferred the plant to Eagle River Chemical Corporation, a newly formed Arkansas corporation which was initially controlled by the Ansul Company. Under Ansul's management, the plant was converted to the production of dinitrobutylphenol, also known as Dinoseb. In late 1972, Ansul sold its majority stock interest in



ENSAFE

(800) 588-7962
MEMPHIS, TENNESSEE
CHARLESTON,SC CINCINNATI,OH DALLAS,TX JACKSON,TN KNOXVILLE,TN
LANCASTER,PA NASHVILLE,TN NORFOLK,VA PADUCAH,KY PENSACOLA,FL
RALEIGH,NC COLOGNE, GERMANY

FIGURE 1
VICINITY MAP
CEDAR CHEMICAL
RISK ASSESSMENT

DWG DATE: 08/05/99	DWG NAME: BOARD

Eagle River Chemical Corporation back to the corporation, leaving J.A. Williams as the sole shareholder. Eagle River Chemical Corporation was subsequently merged into Vertac Chemical Corporation. Vertac operated the plant until CCC acquired the site in 1986.

Solid wastes generated during the period before Vertac's operation are largely unknown. It should be noted that formulation processes vary because of the contract nature of the agricultural chemical business. However, the manufacturing segment is routine and not subject to substantial variation.

1.3 Present Site Operations

CCC, which employs approximately 125 people, manufactures various agricultural chemicals including insecticides, herbicides, polymers, and organic intermediates. Plant processes are batch operations with seasonal production fluctuations and constant product introductions. CCC manufactures its own products (such as Propanil, a rice herbicide) and also custom manufactures chemicals for contract clients. Formulation and packaging are ancillary activities, and are conducted only when the product is ready for the consumer market.

The facility consists of six production units. Unit 1 formulates various custom agricultural products for other companies. Unit 2 is the Propanil production unit. Unit 3 was destroyed in a fire and explosion on September 26, 1989. Unit 4 produces various custom products. Unit 5 primarily manufactures nitroparaffin derivatives. In 1991, Unit 6 began producing dichloroaniline, which is used in the production of Propanil. Figure 2 presents a facility map.

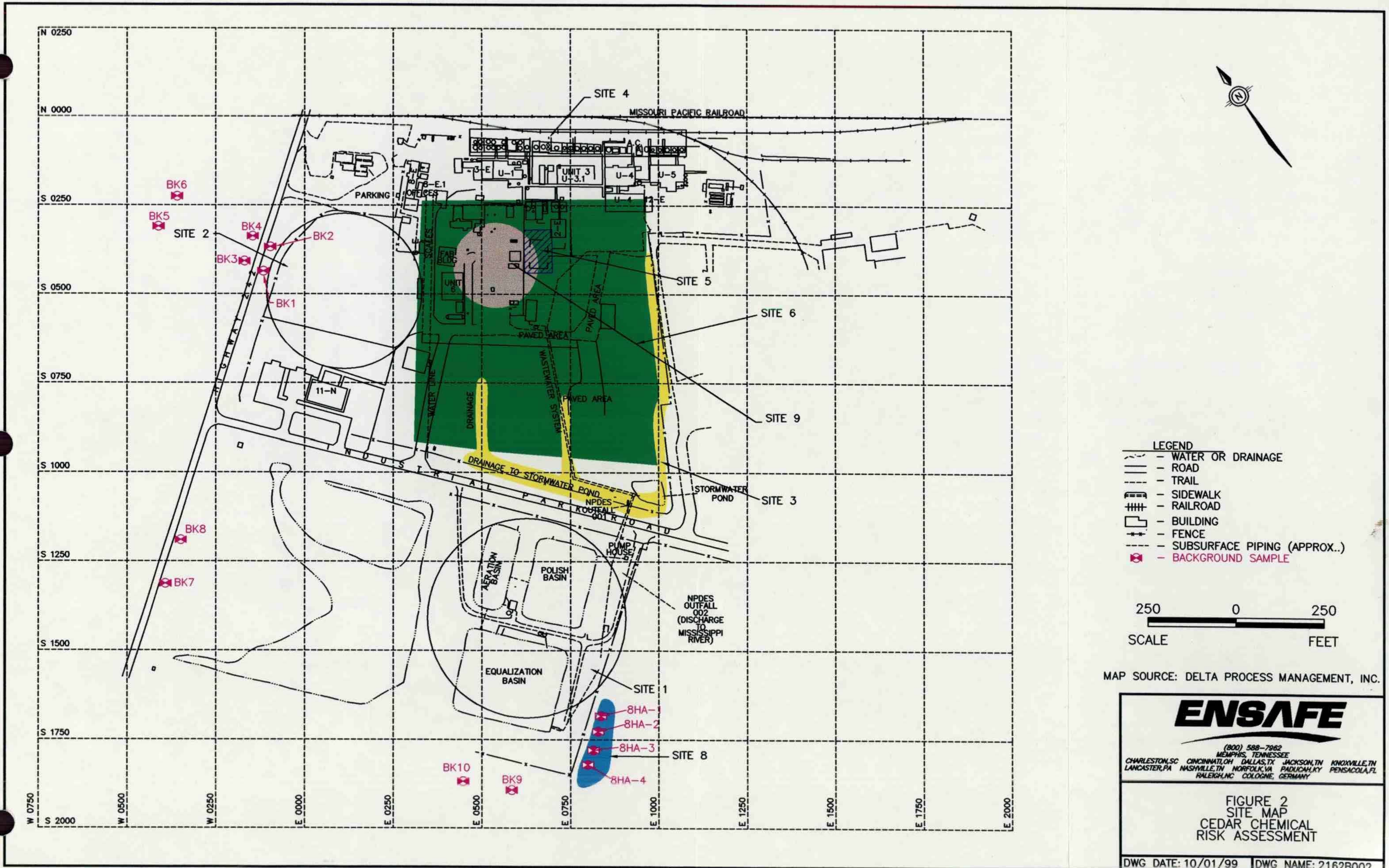


FIGURE 2
SITE MAP
CEDAR CHEMICAL
RISK ASSESSMENT

2.0 HUMAN HEALTH RISK ASSESSMENT

Most baseline risk assessments are divided into two parts — one addressing human health risk, and the other assessing ecological risk. This section assesses human health risk at CCC. Ecological risk is assessed in Section 3. Methods used to reach the conclusions of this HHRA are discussed in the following sections.

2.1 Areas of Concern

For the HHRA, the CCC facility was evaluated based on the eight sites that were defined during the RCRA Facility Investigation (RFI). The sites were grouped based on the exposure setting and chemicals detected. Each site and its use are described below.

Site 1: Site 1, presented in Figure 3, includes four solid waste management units (SWMUs): Wastewater Tank 2 (SWMU 63), the Flow Equalization Basin (SWMU 64), the Aeration Basin (SWMU 65), and the Polish Pond (SWMU 68), that are part of the wastewater treatment system. The treatment system is in the southeast corner of the site across Industrial Park Road. Perched groundwater was encountered at approximately 12 feet below ground surface (bgs). Site 1 is all grass.

Site 2: SWMUs 69, 70, and 71 (Figure 4) are part of a three-pond wastewater treatment system used from 1970 to 1978. In 1978, the ponds were drained by a disposal contractor and filled with soil from the CCC property. Ponds 1 and 2 were approximately 120 feet × 150 feet × 10 feet deep and Pond 3 was approximately 30 feet × 150 feet × 4 feet deep. The unlined units were constructed of earthen fill. Pond 3 also contained limestone for acid neutralization. The units received wastes from onsite production processes and some wastes generated offsite until 1978; wastes included propionic acid, calcium chloride solution, and neutralized sulfuric acid waste. This list does not

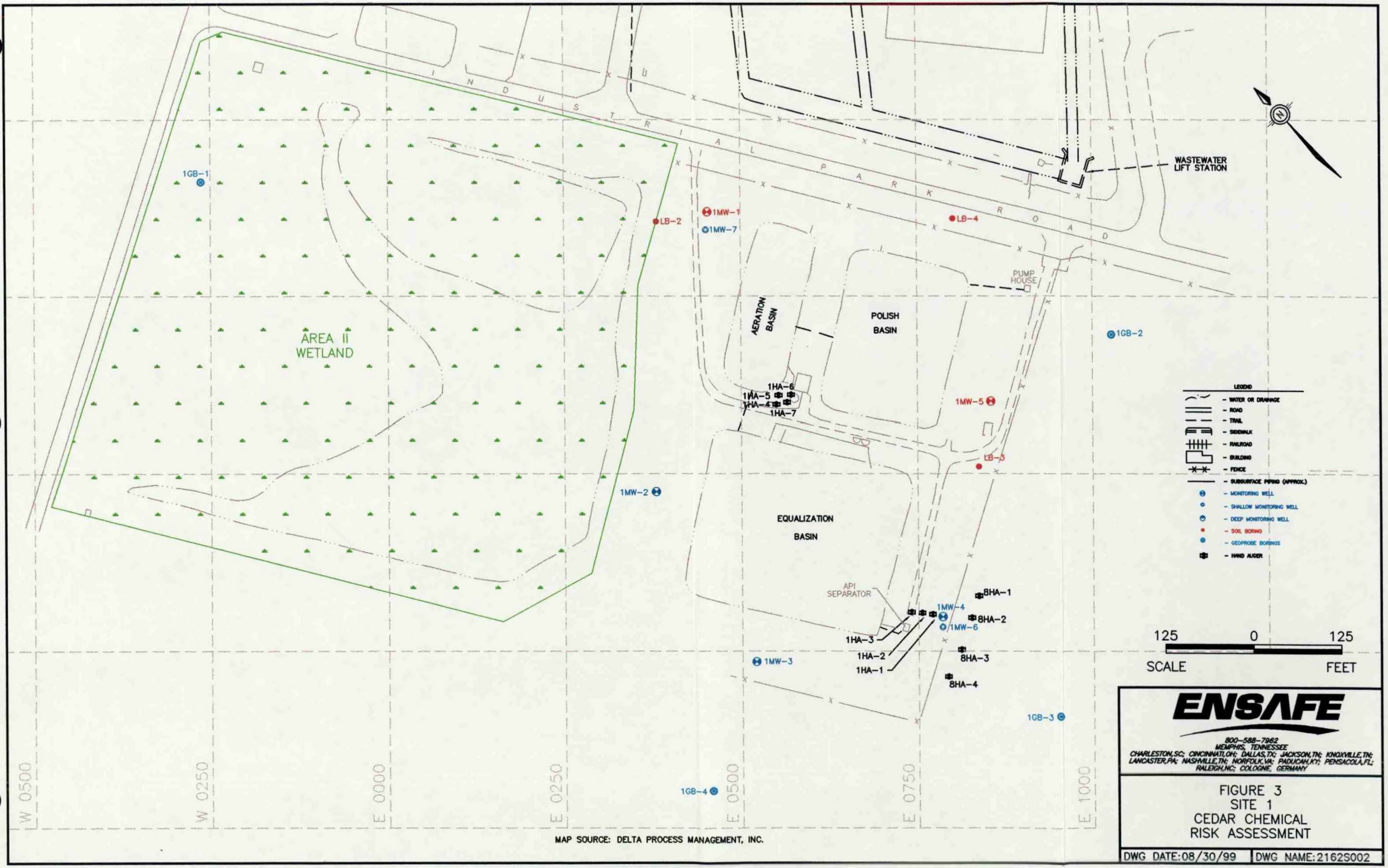


FIGURE 3
SITE 1
CEDAR CHEMICAL
RISK ASSESSMENT

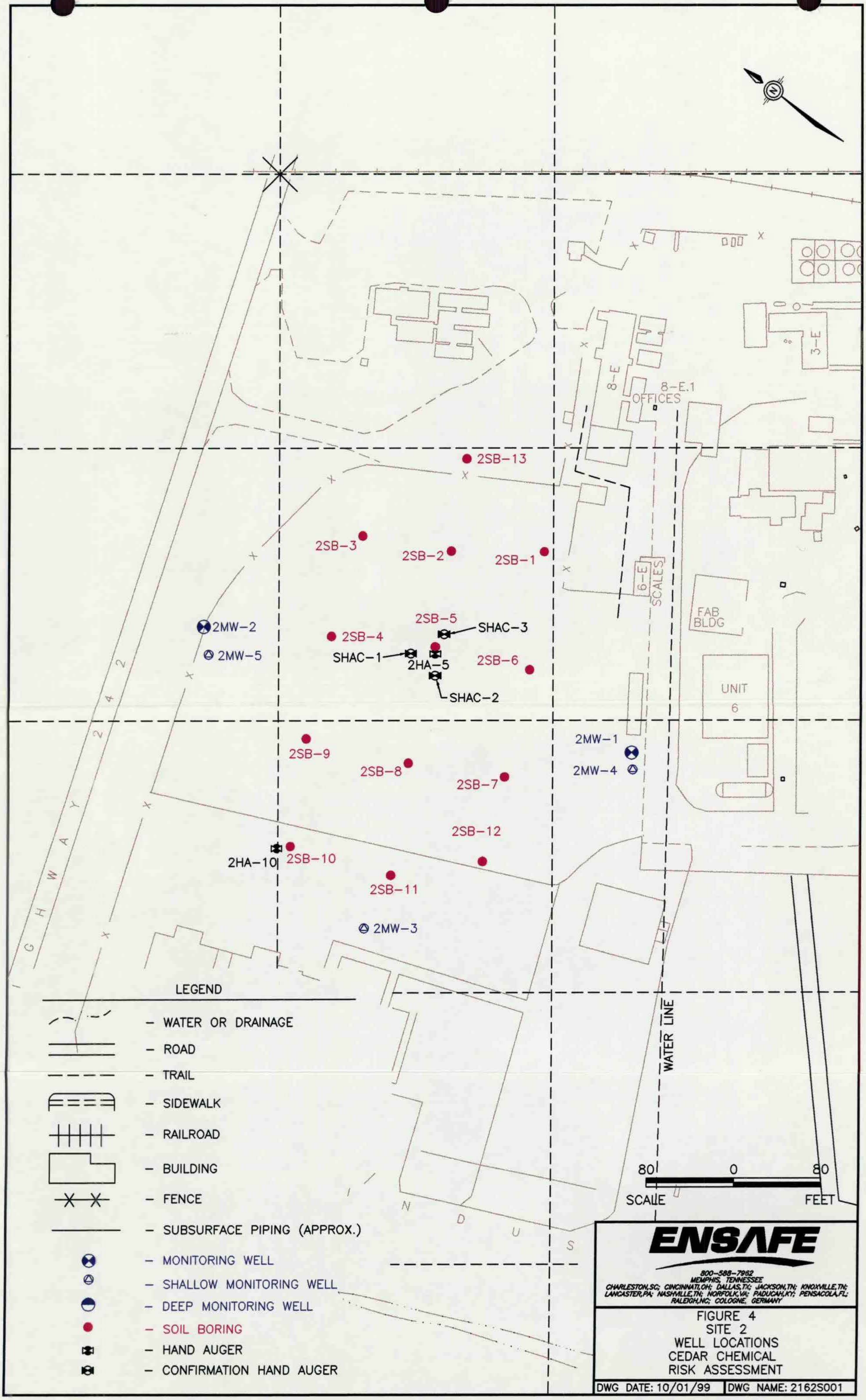


FIGURE 4
SITE 2
WELL LOCATIONS
CEDAR CHEMICAL
RISK ASSESSMENT

DWG DATE: 10/01/99 | DWG NAME: 2162S001

include the wastes disposed of at this site by Helena Chemical Company. Helena formulated 100 to 200 compounds, any of them could have been disposed of in these ponds. Currently Site 2 has gravel, sparse vegetation, and dirt as ground cover. Perched groundwater was encountered approximately 12 feet beneath this site.

Site 3: Site 3 includes two SWMUs which constitute the storm water drainage system. All storm water runoff at the facility was formerly collected in four storm water ditches (SWMU 59), which flowed southwest through the interior of the property . These ditches drained into a larger storm water ditch adjacent to Industrial Park Road. The storm water drainage system has been reconstructed with only one interior ditch remaining. The remaining ditch discharges into the larger storm water ditch adjacent to the road. This large ditch flows south into the storm water sump (SWMU 60), which was formerly the storm water pond. The contents of the sump are periodically pumped into the wastewater treatment system directly across Industrial Park Road. Figure 5 presents the site with all four storm water ditches.

Site 4: Site 4, presented as Figure 6, includes the main production area of the plant and has two SWMUs, the railroad loading and unloading area (SWMU 74) and an abandoned railroad loading and unloading sump (SWMU 3). Both SWMUs are between the railroad spur and the main tank farm where raw materials and final products are transferred between the tank farm and railroad cars. Staining in this area indicated that releases may have occurred during past transfer operations. Currently this site has gravel and sparse vegetation as ground cover.

Site 5: This unit is a concrete vault with walls of poured concrete, a subfloor of gravel, sand, and possibly cement, and a concrete cap that forms the floor of the warehouse onsite. In addition to fill sand and gravel, the vault contains approximately 250 drums of solidified, low-grade herbicide which did not meet product specifications. It is thought that the drums were placed in the vault

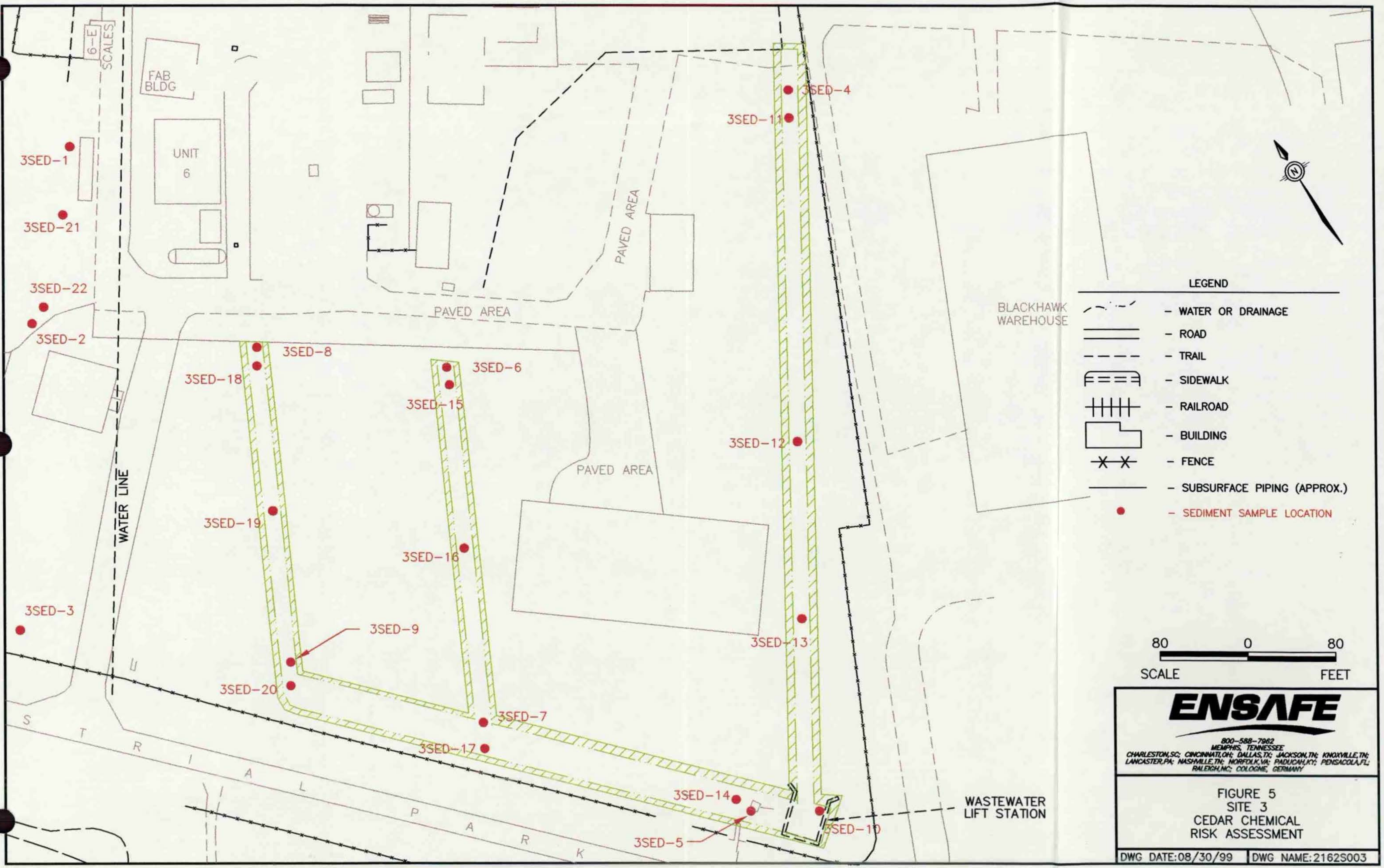
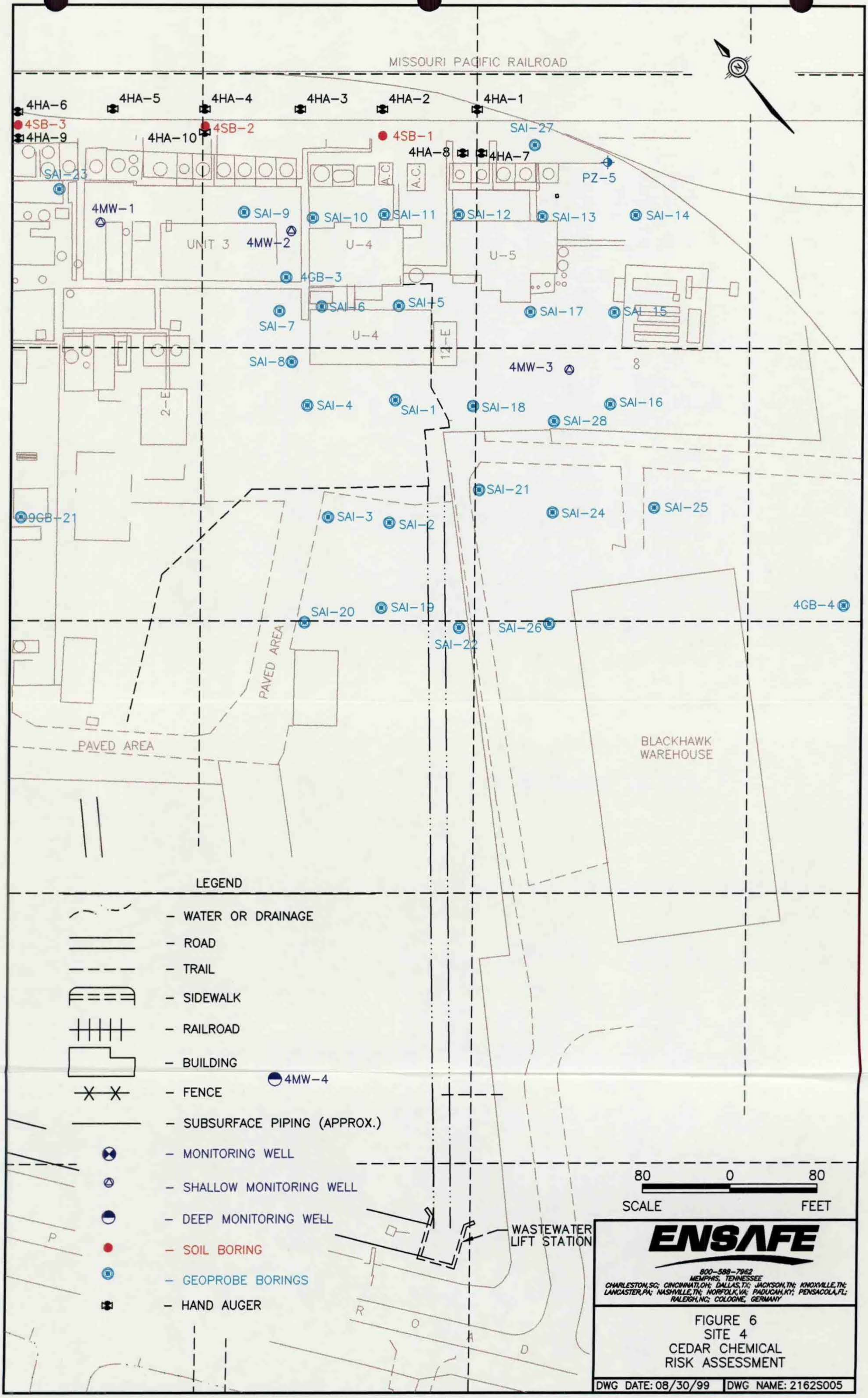


FIGURE 5
SITE 3
CEDAR CHEMICAL
RISK ASSESSMENT



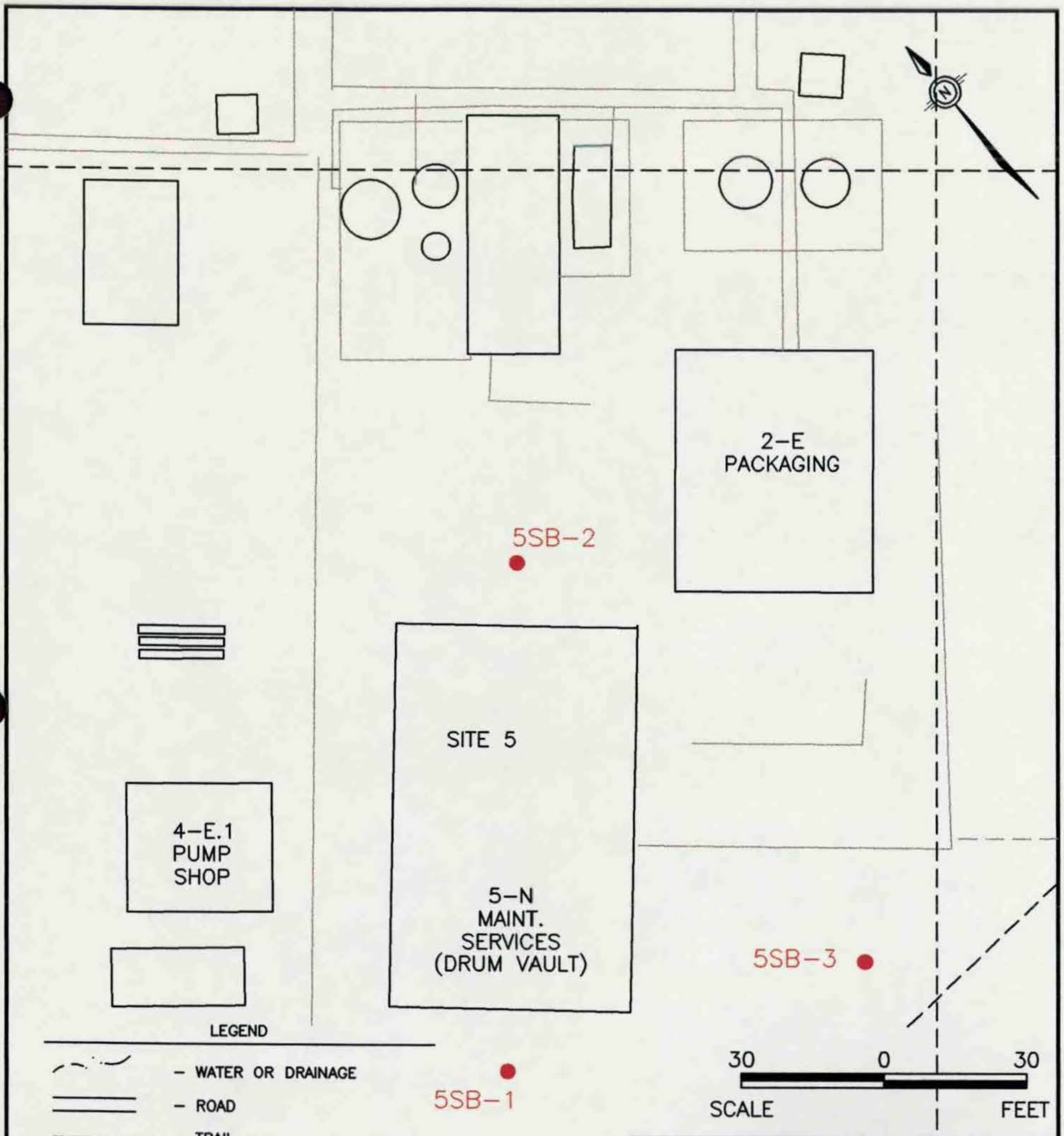
MISSOURI PACIFIC RAILROAD
4HA-6
4HA-5
4HA-4
4HA-3
4HA-2
4HA-1
4SB-3
4SB-2
4SB-1
4HA-9
4HA-10
4HA-8
4HA-7
SAI-27
PZ-5
SAI-23
4MW-1
SAI-9
SAI-10
SAI-11
SAI-12
SAI-13
SAI-14
UNIT 3
4MW-2
U-4
U-5
A.C.
4GB-3
SAI-6
SAI-5
SAI-17
SAI-15
SAI-7
U-4
12-E
SAI-8
4MW-3
2-E
SAI-4
SAI-1
SAI-18
SAI-16
SAI-28
SAI-21
9GB-21
SAI-3
SAI-2
SAI-24
SAI-25
SAI-20
SAI-19
SAI-22
SAI-26
4GB-4
PAVED AREA
PAVED AREA
BLACKHAWK WAREHOUSE
4MW-4
WASTEWATER LIFT STATION
ROAD
LEGEND
- WATER OR DRAINAGE
- ROAD
- TRAIL
- SIDEWALK
- RAILROAD
- BUILDING
- FENCE
- SUBSURFACE PIPING (APPROX.)
- MONITORING WELL
- SHALLOW MONITORING WELL
- DEEP MONITORING WELL
- SOIL BORING
- GEOPROBE BORINGS
- HAND AUGER
80 0 80
SCALE FEET
ENSAFE
800-588-7962
MEMPHIS, TENNESSEE
CHARLESTON,SC; CINCINNATI,OH; DALLAS,TX; JACKSON,TN; KNOXVILLE,TN; LANCASTER,PA; NASHVILLE,TN; NORFOLK,VA; PADUCAH,KY; PENSACOLA,FL; RALEIGH,NC; COLOGNE, GERMANY
FIGURE 6
SITE 4
CEDAR CHEMICAL
RISK ASSESSMENT
DWG DATE: 08/30/99
DWG NAME: 2162S005

in early 1976. Because evaluation of the drum vault is outside the scope of this risk assessment, it will be addressed as part of the CMS for the site. Site 5 is presented as Figure 7.

Site 6: Site 6 (Figure 8) is the open, non-production area of the plant between storm water ditches and the equipment warehouse. Portions of this site have been paved. Site 6 includes several areas of the plant where yellow staining is visible, particularly after rain, indicating the presence of Dinoseb. The staining appears to be dispersed across Site 6, with some areas more heavily stained than others.

Site 8: Site 8 (Figure 9) is a ditch on the south side of the wastewater treatment ponds. In the past, the API separator would overflow and wastewater destined for the treatment ponds would flow into the industrial park ditch. To remediate this problem, the separator and pad were cleaned and a gutter was installed in February 1992. The gutter was designed to divert all overflow into the equalization pond. The contaminated soil in the ditch was also removed, placed in drums, and sent to the Chemical Waste Management Subtitle C landfill in Carlyss, Louisiana; however, no confirmatory sampling of the ditch was performed. All storm water is currently discharged to NPDES Outfall No. 002 via the treatment ponds.

Site 9: Site 9 (Figure 10) consists of three suspected abandoned ponds in the area between the dichloroaniline unit and the maintenance services building (Site 5). The ponds are reported to have been shallow, unlined basins used to dispose of off-specification Dinoseb. The ponds are no longer used and have since been backfilled. Buildings have been constructed near the ponds and some areas have been paved or covered with gravel.

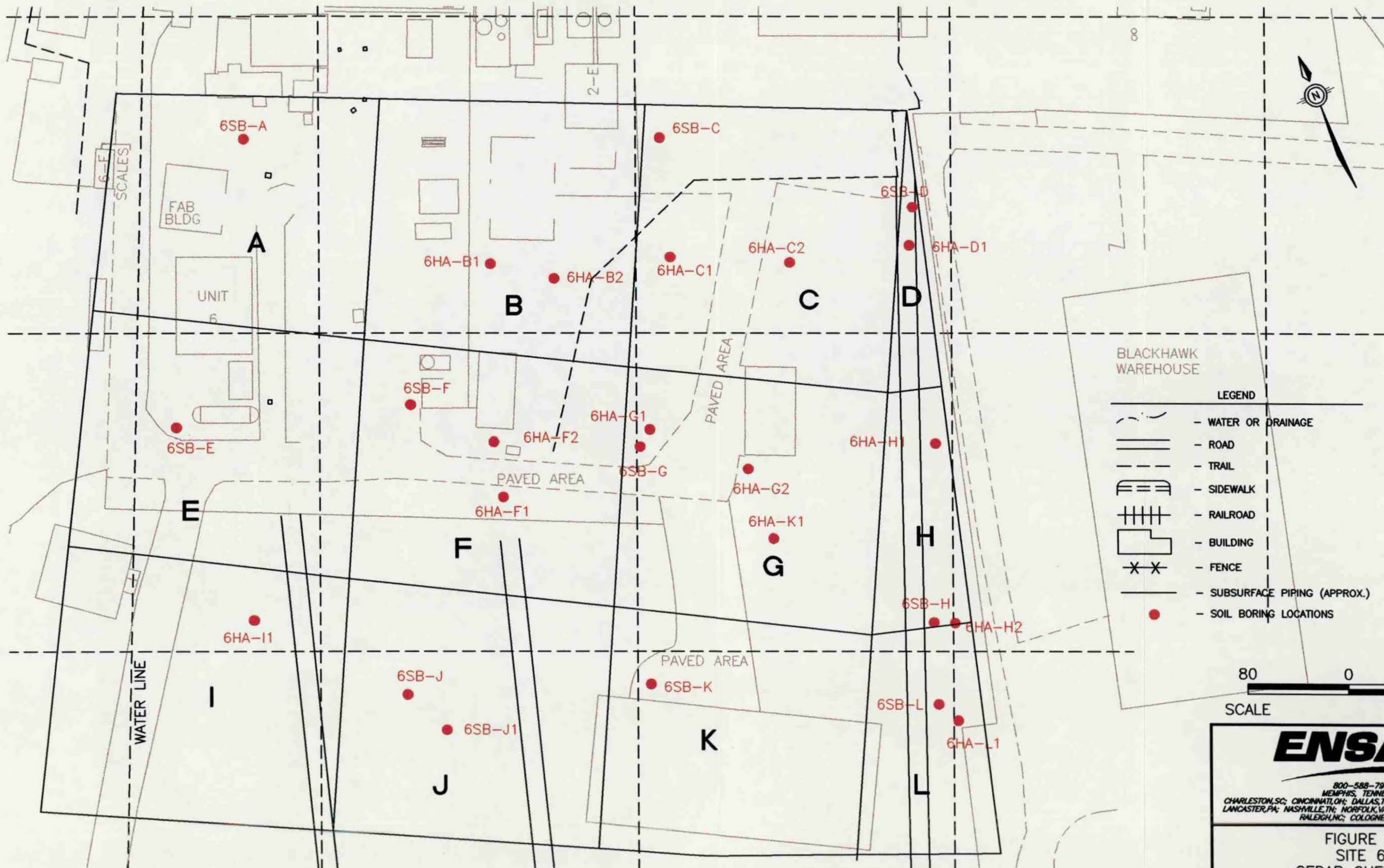


ENSAFE

800-588-7962
MEMPHIS, TENNESSEE
CHARLESTON,SC; CINCINNATI,OH; DALLAS,TX; JACKSON,TN; KNOXVILLE,TN; LANCASTER,PA; NASHVILLE,TN; NORFOLK,VA; PADUCAH,KY; PENSACOLA,FL; RALEIGH,NC; COLOGNE, GERMANY

FIGURE 7
SITE 5
CEDAR CHEMICAL
RISK ASSESSMENT

DWG DATE: 08/30/99 | DWG NAME: 2162S004



ENSAFE
800-588-7962
MEMPHIS, TENNESSEE
CHARLESTON,SC; CINCINNATI,OH; DALLAS,TX; JACKSON,TN; KNOXVILLE,TN; LANCASTER,PA; NASHVILLE,TN; NORFOLK,VA; PADUCAH,KY; PENSACOLA,FL; RALEIGH,NC; COLOGNE, GERMANY

FIGURE 8
SITE 6
CEDAR CHEMICAL
RISK ASSESSMENT

DWG DATE: 08/30/99 | DWG NAME: 2162S006

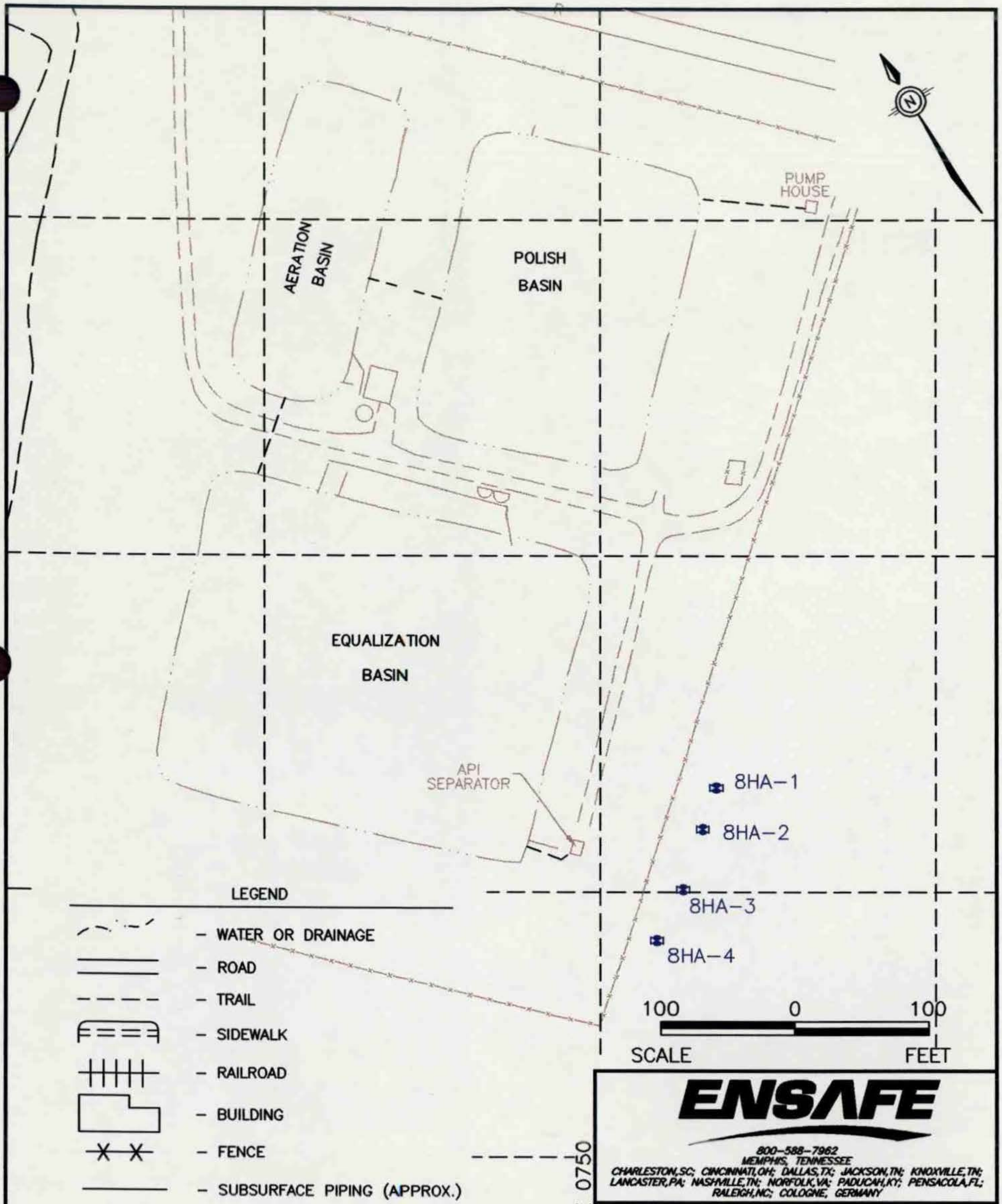


FIGURE 9
SITE 8
CEDAR CHEMICAL
RISK ASSESSMENT

DWG DATE: 08/30/99 | DWG NAME: 2162S007

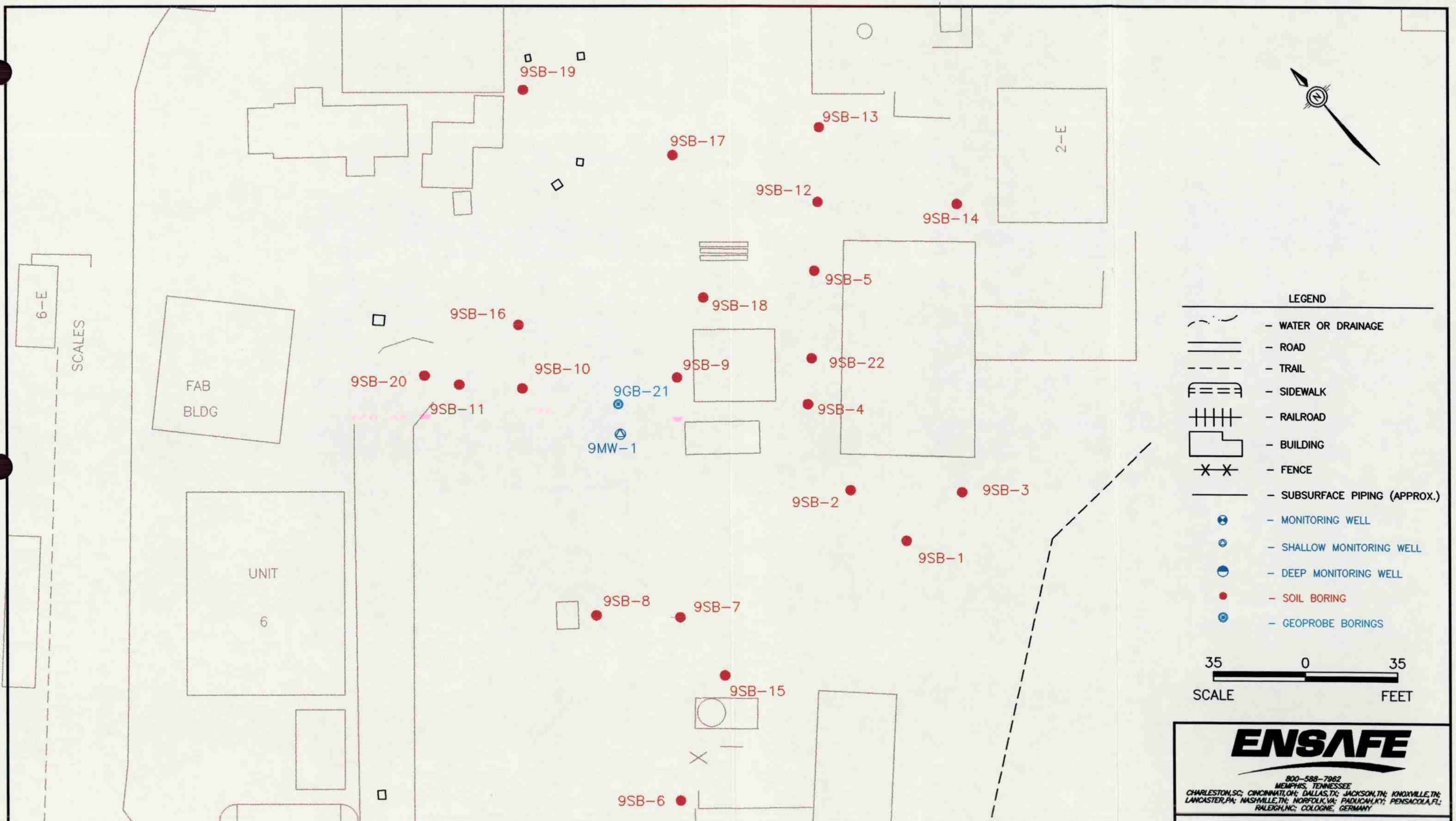


FIGURE 10
SITE 9
CEDAR CHEMICAL
RISK ASSESSMENT

DWG DATE: 08/30/99 | DWG NAME: 2162S008

2.2 Data Collection and Evaluation

This section summarizes analytical data collected for the site, identifies chemicals of potential concern (COPCs), and determines chemical-specific concentrations to be used in the risk assessment.

2.2.1 Historical Data Evaluation

This section summarizes results of investigations conducted for CCC. Several sampling investigations have been completed for the CCC property. During these investigations, groundwater, sediment, and soil were sampled for Resource Conservation and Recovery Act (RCRA) metals, pesticides, and polychlorinated biphenyls, semivolatile organic compounds, and volatile organic compounds (VOCs). However, not all parameters were analyzed for each sampling investigation. Sampling events and parameters analyzed to develop this HHRA are detailed in the RCRA Facility Investigation report (EnSafe, 1996). Additional surface soil samples were collected at Site 2 to determine if the arsenic detection of 98.1 parts per million (ppm) was an anomaly. Three samples were collected approximately 10 to 40 feet from soil boring 2SB-5 (Figure 4). The analytical data from these locations were considered discrete samples for screening. Because the additional samples did not confirm the original detection of 98.1 ppm, the high detection was considered an anomaly and not used for screening or calculating the concentration used to quantitate risk.

All analytical data used in this baseline risk assessment is presented in Appendix B.

2.2.2 Scope of Work for Risk Assessment

The overall framework used in this HHRA is based on information presented in the Risk Assessment Work Plan (EnSafe, 1998) which uses approved USEPA guidance:

- *Risk Assessment Guidance for Superfund (RAGS), Volume I — Human Health Evaluation Manual (Part A)*, (RAGS Part A) (USEPA, 1989).

- *RAGS, Volume I — Human Health Evaluation Manual, Supplemental Guidance — Standard Default Exposure Factors — Interim Final,* (USEPA, 1991).

- *RAGS, Volume I — Human Health Evaluation Manual, Supplemental Guidance — Dermal Risk Assessment — Interim Guidance*, (USEPA, 1992a).

- *RAGS, Volume 1 — Human Health Evaluation Manual (Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments) — Interim* (USEPA, 1998).

- *Supplemental Guidance to RAGS: Calculating the Concentration Term* (USEPA, 1992b).

- *Supplemental Guidance to RAGS: Region IV Bulletins*, (USEPA Region IV, 1995a).

- *Screening Method for Estimating Inhalation Exposure to Volatile Chemicals from Domestic Water*. (USEPA, 1995b).

- *Exposure Factors Handbook* (USEPA, 1997a).

- *USEPA Region VI Human Health Medium-Specific Screening Levels,* (MSSLs) (USEPA Region VI, May 1999).

- *Guidance on Preliminary Risk Evaluations (PREs) for the Purpose of Reaching a Finding of Suitability to Lease* (USEPA, 1994).

2.2.3 Identification of Chemicals of Potential Concern

Analytical results for all media are summarized in the RFI (EnSafe, 1996) for groundwater, sediment, and soil. The following briefly reviews criteria used to identify COPCs for CCC.

For this HHRA, soil and sediment data were evaluated by site, while groundwater is evaluated separately as either perched or alluvial. Although soil and sediment could be evaluated on a site-wide basis, these media were examined by site because of the unique site features, uses, and the chemicals detected at each. Most importantly a site-by-site evaluation is most conservative because it assumes receptors will be exposed to one area for the entire exposure period.

The list of chemicals detected in site media was reduced by comparing site-related data to risk-based screening levels and site-related background concentrations, when available.

2.2.3.1 Comparison of Data to Risk-Based Screening Values

The maximum detected concentrations were compared to MSSLs provided in USEPA Region VI Human Health Media-Specific Screening Levels (May 1999). As stated in the USEPA Region VI document, MSSLs were based on a risk goal of 1E-06 for carcinogenic effects and a hazard quotient (HQ) of 1 for noncarcinogenic effects. The sections that follow describe additional screening elements for each media.

Perched Groundwater

As recommended by the Arkansas Department of Environmental Quality (ADEQ), groundwater data were screened against the more stringent of the following values: either USEPA Drinking Water Standards (MCLs) or risk-based screening values adjusted for the industrial-use scenario. Because USEPA Region VI does not provide industrial tap-water screening values, USEPA Region IV Guidance, which is included as Appendix C, was used to convert residential tap water risk-based concentrations (MSSLs) to industrial MSSLs (USEPA, 1994). Using this method, residential RBCs for VOCs are divided by 0.25 and RBCs for all other chemicals are divided by 0.5. RBCs were converted and presented in Table 1. Chemicals reported in perched groundwater were excluded from the HHRA if the reported maximum concentrations are less than the selected screening values.

Alluvial Groundwater

Although alluvial groundwater exposures are based on the inhalation pathway, the more stringent of risk-based concentrations for ingestion and MCLs were used to screen volatile organic compound (VOC) concentrations in alluvial groundwater.

Soil (Surface and Subsurface) and Sediment

Reported maximum surface soil (0 to 1 foot bgs) and sediment concentrations were compared to residential MSSLs based on ingestion. For the industrial scenario, maximum reported surface and subsurface soil (all depths) concentrations were compared to industrial MSSLs based on ingestion. When necessary, chemicals that did not have a published MSSL were compared to a surrogate MSSL. Surrogate compounds were selected based on structural, chemical, or toxicological similarities and are indicated on each screening table.

Subsurface Soil Screening Levels

Because chemicals present in subsurface soil may potentially leach to groundwater and act as a continuing source of groundwater contamination, subsurface data (all depths) were compared to site-specific soil screening levels (SSLs). A site-specific dilution attenuation factor of 1.05 was calculated using Equations 1 and 2 and assumptions regarding the hydrogeology of the site presented in the *Cedar Chemical Corporation Facility Investigation* (EnSafe, 1996).

$$dilution\ factor = 1 + \frac{Kid}{IL} \qquad \text{Equation 1}$$

$$d = \left(0.0112L^2\right)^{0.5} + d_a\left\{1 - \exp\left[(-LI) / Kid_a\right]\right\} \qquad \text{Equation 2}$$

Variables for Equations 1 and 2

- K = aquifer hydraulic conductivity (30,372 m/yr) (EnSafe, 1996)
- i = hydraulic gradient (0.00018 m/m) (EnSafe, 1996)
- I = infiltration rate (289 m/yr) (calculated assuming a permeability of 0.6 to 2 in/hr)
- d = mixing zone depth (calculated using Equation 2)
- L = source length parallel to ground water flow (12 m) (EnSafe, 1996)
- d_a = aquifer thickness (34.8 m) (EnSafe, 1996)

SSLs were calculated using Equations 3 and 4. The target concentrations used in Equation 4 is the MCL when available or the Region VI tap-water screening value. Site-specific SSLs are presented in Table 2.

$$C_t = C_w\left(K_d + \frac{\theta_w + \theta_a H'}{\rho_b}\right) \qquad \text{Equation 3}$$

$$C_t = C_w\left(\left(K_{oc} f_{oc}\right) + \frac{\theta_w + \theta_a H'}{\rho_b}\right) \qquad \text{Equation 4}$$

Variables for Equations 3 and 4

- C_t = screening level in soil (mg/kg)
- C_w = target soil leachate concentration (mg/L)
- K_d = soil-water partition coefficient (L/kg) (chemical-specific)
- θ_w = water-filled soil porosity (unitless) (0.3)
- θ_a = air-filled soil porosity (unitless) (0.13)
- ρ_b = dry soil bulk density (1.5 kg/L)
- H' = dimensionless Henry's law constant (chemical-specific)
- K_{oc} = soil organic carbon-water partition coefficient (L/kg) (chemical-specific)
- f_{oc} = organic carbon content of soil (0.002 kg/kg)

2.2.3.2 Comparison of Data to Background Concentrations

Limited background surface soil samples were collected for CCC. No background samples were collected for subsurface soil and groundwater. Except for arsenic, background surface soil concentrations were determined for inorganics using results from three background sampling locations. The background concentration for these inorganics was established as the mean, plus two standard deviations. Table 3 presents background data.

Ten additional surface soil samples (CEDSBKG101 - CEDSBKG901 and CEDSBK1001) were collected to assess arsenic background concentrations. All results for these samples were initially used to develop a representative background concentration using the 95th UCL. However, at the request of ADEQ, who indicated that the arsenic concentrations for sample locations CEDSBKG101, CEDSBKG401, and CEDSBKG801 were unusually high and might not be associated with naturally occurring levels in surface soil, these samples were removed from the background calculation. The arsenic background concentration was calculated using the mean concentration plus two standard deviations. The new background concentration, 11.6 mg/kg, is used for COPC selection. Table 3 presents background data. Background sampling locations are presented in Figure 2.

After comparison to risk-based screening values, detected metals concentrations were compared to site-specific background concentrations. Only metals exceeding the MSSL and background concentrations were retained as COPCs.

2.2.3.3 Chemicals of Potential Concern

COPCs identified for soil and sediment at each of the eight sites are presented below.

Site	Surface Soil	Surface and Subsurface Soil	Sediment
Site 1	arsenic, dieldrin, 1,2-dichloroethane	arsenic, dieldrin, 1,2-dichloroethane	arsenic, chromium
Site 2	aldrin, Dinoseb	arsenic, chromium, mercury, aldrin, dieldrin, 1,2-dichloroethane, chloroform, methylene chloride	none collected

Site	Surface Soil	Surface and Subsurface Soil	Sediment
Site 3	none collected	Dinoseb	arsenic, aldrin, dieldrin, toxaphene, pentachlorophenol
Site 4	dieldrin, Dinoseb	arsenic, dieldrin, Dinoseb, 3,4-dichloroaniline, 1,2-dichloroethane	none collected
Site 5	none collected	No COPCs were identified.[a]	none collected
Site 6	aldrin, dieldrin, methoxychlor, toxaphene, Dinoseb	none collected	none collected
Site 8	No COPCs were identified.	none collected	none collected
Site 9	heptachlor, Dinoseb, 3,4-dichloroaniline, Propanil	arsenic, Dinoseb, 3,4-dichloroaniline, Propanil	none collected

Note:
a = All sample depths for Site 5 exceed 10 feet. Because no receptors contact soil below 10 feet, no COPCs were selected.

The following COPCs were identified for perched groundwater: arsenic, barium, cadmium, chromium, lead, 4,4'-DDT, alpha-BHC, 2,6-dinitrotoluene, 3,4-dichloroaniline, 4-chloroaniline, bis(2-chloroethyl)ether, Dinoseb, 1,2-dichloroethane, 4-methyl-2-pentanone, acetone, benzene, chloroform, methylene chloride, and trichloroethene.

The COPCs identified for alluvial groundwater are: 1,1,2-trichloroethane, 1,2-dichloroethane, 1,2-dichloropropane, acetone, benzene, bromodichloromethane, chlorobenzene, chloroform, dibromochloromethane, methylene chloride, 4-methyl-2-pentanone, and toluene.

SSL Screening Results

Chemical concentrations exceeding site-specific SSLs are presented below.

Site	Chemical	Exceeds Site-Specific SSL	Detected in Perched Groundwater	Detected in Alluvial Groundwater	Leaching Ability
1	beta-BHC	Yes	No	No	NA
	Dieldrin	Yes	No	No	NA
	1,2-Dichloroethane	Yes	Yes	Yes	mobile
	Chloroform	Yes	Yes	Yes	mobile
2	Aldrin	Yes	No	No	NA
	alpha-BHC	Yes	Yes	No	low mobility
	Dieldrin	Yes	No	No	NA
	bis(2-Chloroethyl)ether	Yes	Yes	No	mobile
	Dinoseb	Yes	Yes	No	pH dependent; low pH = adsorption; high pH = mobile
	1,2-Dichloroethane	Yes	Yes	Yes	Yes
2	Chloroform	Yes	Yes	Yes	Yes
	Methylene chloride	Yes	Yes	Yes	Yes
3	Dinoseb	Yes	Yes	No	pH dependent; low pH = adsorption; high pH = mobile
4	Dieldrin	Yes	NA	No	NA
	3,4-Dichloroaniline	Yes	NA	No	NA
	Lead	Yes	Yes	No	NA
	Dinoseb	Yes	NA	No	pH dependent; low pH = adsorption; high pH = mobile
	Propanil	Yes	NA	No	NA
5	Dinoseb	Yes	NA	No	pH dependent; low pH = adsorption; high pH = mobile
9	3,4-Dichloroaniline	Yes	NA	No	NA
	Dinoseb	Yes	NA	No	pH dependent; low pH = adsorption; high pH = mobile
	Propanil	Yes	NA	No	NA

Note:
NA = not applicable

SSLs are used to determine the potential for chemicals in soil to migrate to groundwater. Because SSLs do not address variables such as natural attenuation, the screening results are only a general indicator that migration will occur. The screening results indicate that the only chemicals likely to migrate to groundwater are the VOCs: 1,2-dichloroethane, bis(2-chloroethyl)ether, chloroform, and methylene chloride. Based on alluvial groundwater data, the only contaminants that have been detected in groundwater are the VOCs identified. Although the SSL data indicate that other contaminants may migrate to groundwater, this has not occurred. Only VOCs exceeding the SSLs and detected in alluvial groundwater will be quantitatively evaluated in the HHRA.

Screening perched groundwater data against SSLs indicates that the contaminant detections that exceed the MSSL are: 1,2-dichloroethane, alpha-BHC, bis(2-chloroethyl) ether, Dinoseb, chloroform, and methyl chloride. Although the perched groundwater data indicate that chemicals have migrated, these chemicals are not likely to migrate to the alluvial aquifer because the two aquifers are not connected. All chemicals exceeding the SSL that are detected in perched groundwater will be quantitatively evaluated in the HHRA.

Although the evaluation of alluvial and perched groundwater indicates that the chemicals most likely to be a continuing source of contamination to the alluvial aquifer are VOCs, this has not been formally addressed using fate and transport modeling. The fate and transport of chemicals in soil will be evaluated and submitted as part of the interim measures.

Detailed information identifying COPCs detected in soil, sediment, and groundwater samples is presented in the tables indicated below.

Tables 4-9	surface soil
Tables 10-15	subsurface soil
Table 16	perched groundwater
Table 17	alluvial groundwater
Tables 18 and 19	sediment

2.2.3.4 Identification of Transport Routes

Impacted media include surface soil, subsurface soil, sediment, perched groundwater, and alluvial groundwater. Air contamination is possible because of contaminated soil. Airborne COPCs were evaluated as volatiles and particulates. Concentrations of airborne chemicals from soil were calculated using guidance presented in *Soil Screening Guidance* (USEPA, 1996). Air contamination is also possible because of VOCs released to air from contaminated alluvial groundwater. Concentrations of airborne chemicals from both soil and groundwater were determined using the mathematical models presented in Section 2.3.2.

2.2.4 Concentrations to be Used in Risk Assessment

The exposure point concentration (EPC) is the concentration of a contaminant in an exposure medium that may be contacted by a receptor. EPCs were selected using suggestions provided in RAGS Part A. The upper confidence limit of the arithmetic mean (95% UCL) values was estimated using the State of Washington Department of Ecology Model Toxics Cleanup Act statistical software called MTCA*Stat* (Version 2.1). For data sets where a UCL could not be estimated, the maximum detected concentration was selected as the EPC by default. Generally, the maximum concentration was selected as the EPC for the following situations:

- the population of the data set was less than 10
- the 95% UCL was greater than the maximum detected concentration

For the construction worker scenario, which assumes construction activities will be restricted to depths of 10 feet bgs or less, the soil data sets for each site were evaluated to screen out analytical data for samples depths exceeding10 feet bgs. The construction worker scenario data set includes those samples collected between 0 and 10 feet. Because of this sample depth limitation, Site 5 subsurface soil was not evaluated for the construction worker scenario.

The 95% UCL was calculated using the statistical software based on the assumptions listed below when estimating the UCL:

- For nondetects, if the reported sample quantitation limit (SQL) or practical quantitation limit (PQL) exceeded the MSSL, one-half the SQL or one-half the PQL was used as the proxy value. The distribution of this modified data set was then determined. If the data distribution was lognormal, the *H*-statistic was used to estimate the UCL. If the data distribution was normal the *t*-statistic was used to estimate the UCL.

- For data distributions that were determined by the software to be neither normal nor lognormal, a lognormal distribution was assumed and the *H*-statistic was used to estimate the UCL (USEPA, 1992b).

Tables 20 to 33 present the EPC concentrations by site and media. Output tables from the MTCA*Stat* program are presented in Appendix D. Documentation and guidance for the MTCA*Stat* software are also provided in Appendix D. The software for this program can be obtained from http://www.wa.gov/ECOLOGY/tcp/mtcastat.html.

2.3 Exposure Assessment

The objective of the exposure assessment is to estimate the type and magnitude of exposures to the COPCs present at or migrating from a site. For CCC, exposures were evaluated by site and assume receptors are present at only one site during the entire exposure period. This assumption was made because CCC is an active facility where workers are likely to remain at one site during the workday. Based on the current configuration of the site, receptors are most likely to contact contaminated media at Site 4. Sites 1, 2, 3, 5, 6, and 9 are primarily open areas with ground cover of grass, gravel, pavement or building foundations. Descriptions of each site are provided in Section 2.1.

Results of the exposure assessment will be integrated with chemical-specific toxicity information to characterize human health risks potentially associated with the site.

2.3.1 Evaluation of Exposure Pathways

Exposure pathways describe the movement of chemicals from sources such as soil and groundwater to exposure points, where receptors (i.e., potentially exposed populations) may come in contact with chemicals. An exposure pathway is typically defined by four components.

Exposure Pathway Components

- A source and mechanism of chemical release to the environment.
- An environmental transport medium (e.g., air, water) for the released chemicals.
- Potential contact (exposure point) between a receptor and contaminated medium.
- An exposure route (e.g., inhalation, ingestion, dermal contact) at the exposure point.

An exposure pathway is considered complete only if all four components are present. In conducting a risk assessment, only complete exposure pathways are quantitatively evaluated. Exposure pathways that have been identified as potentially applicable to site conditions are presented in Section 2.3.1.3.

2.3.1.1 Physical Setting

Climate

Arkansas has a humid mesothermal climate characteristic of the southeast to south-central United States. Based on www.worldclimate.com, the average rainfall for Helena, Phillips County, is 51.8 inches per year, with the most precipitation occurring between December and May. Phillips County is an attainment area for all primary and secondary air pollutants. The prevailing wind is southwest at an average speed of 8 mph and travels in that direction 12.3% of the time. The average temperatures are listed below.

Average Temperatures

- annual 60.8°F
- maximum 71.4°F
- minimum 50.2°F

Additional climatological data include:

- Heating degree days: The cumulative number of degrees in a month or year by which the mean temperature falls below 18.3°C/65°F.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Year
°C	466	353	227	77	19	0	0	0	8	80	223	396	1854
°F	839	635	409	139	34	0	0	0	14	144	401	713	3337

Source:
www.worldclimate.com/cgi-bin/data.pl?ref=N34W090+1302+033242C.

- Cooling degree days: The cumulative number of degrees in a month or year by which the mean temperature is above 18.3°C/65°F.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Year
°C	0	0	5	27	105	210	273	244	142	32	0	0	1041
°F	0	0	9	49	189	378	491	439	256	58	0	0	1874

Source:
www.worldclimate.com/cgi-bin/data.pl?ref=N34W090+1308+033242C

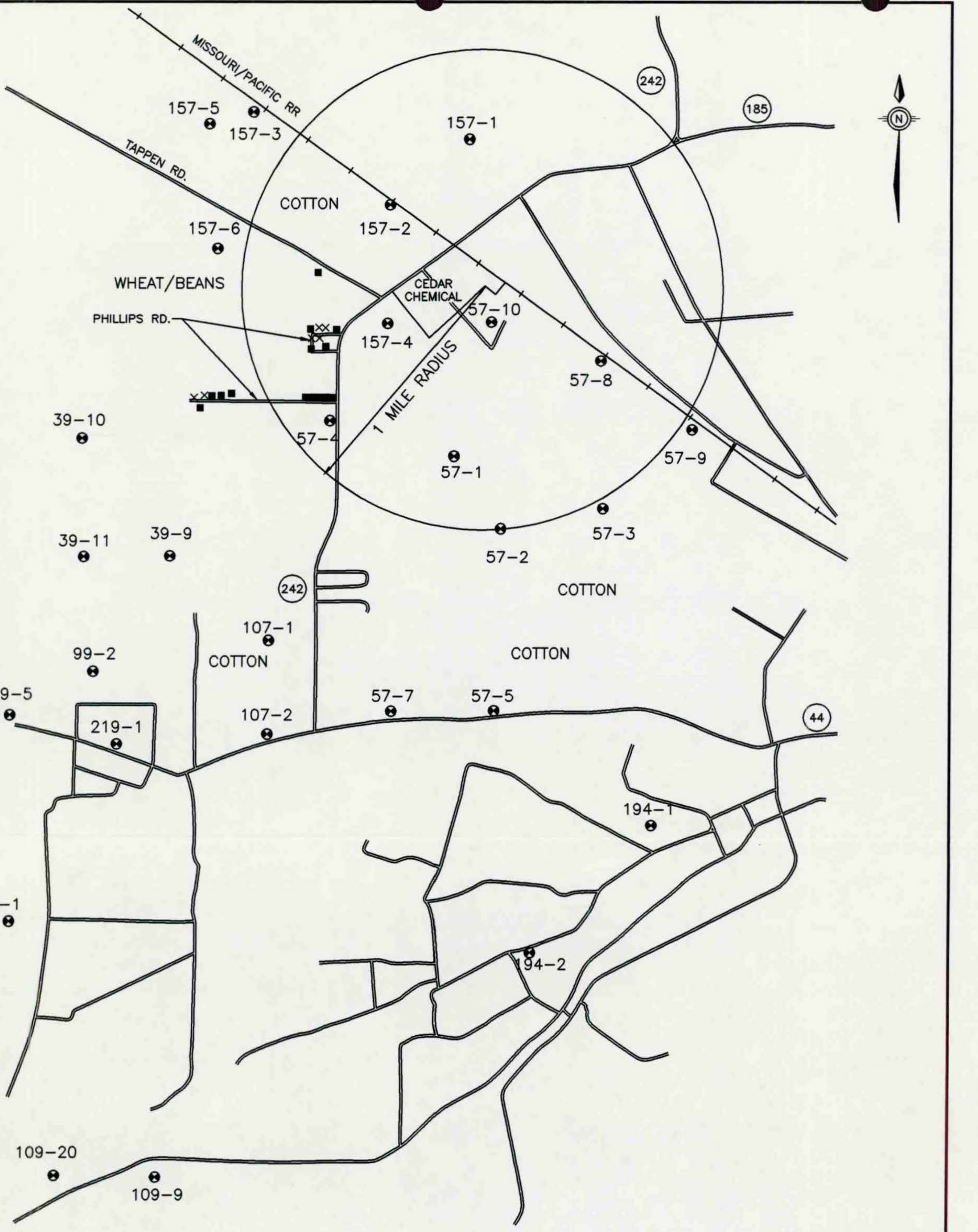
Output from the www.worldclimate.com website is provided in Appendix E.

Groundwater Uses

Onsite: The CCC plant receives water from two potable water supplies. The front offices, shower room, and laboratory receive potable water from the City of West Helena. The City of Helena supplies the rest of the plant. Both cities obtain groundwater from the Sparta Sand aquifer, which is a confined aquifer approximately 400 feet bgs (USGS, 2000 and EnSafe, 1996).

Offsite: During preparation of the 1995 *Interim Response Work Plan* (EnSafe, 1995), a well survey identified residential and agricultural wells near the site. The sections below describe the results of the residential and agricultural well survey. Figure 11 presents residential and agricultural wells near CCC.

Residential Wells: Nineteen residences cross gradient from the CCC facility were either visited or observed during the residential well survey. Several of the cross gradient residences are within a 1-mile radius of the site, primarily on Phillips Road. Wells formerly supplied all residences with domestic water; however, all homes have been connected to the city water system for more than 10 years. Based on the 1995 survey and August 2000 followup, the wells are currently in various states of disrepair: some are capped, some are open with no pumps, others have unusable pumps. Because the wells do not function, water from them is not used. The text below indicates that none of the residences surveyed is currently using private wells as a source of general use water. If new residences were built on agricultural land surrounding CCC, these structures must receive drinking water from the City of Helena or City of West Helena.



LOCATIONS ARE APPROXIMATE

LEGEND

⊖ – AGRICULTURAL WELLS

■ – RESIDENTS INCLUDED IN WELL SURVEY

× – RESIDENTS WITH WELLS, NOT IN SURVEY

ENSAFE

800-588-7962
MEMPHIS, TENNESSEE
CHARLESTON,SC; CINCINNATI,OH; DALLAS,TX; JACKSON,TN; KNOXVILLE,TN; LANCASTER,PA; NASHVILLE,TN; NORFOLK,VA; PADUCAH,KY; PENSACOLA,FL; RALEIGH,NC; COLOGNE, GERMANY

FIGURE 11
AGRICULTURAL AND RESIDENTIAL WELL LOCATIONS
CEDAR CHEMICAL
RISK ASSESSMENT

DWG DATE: 08/30/99	DWG NAME: 2162S009

Residential Well Survey Results			
Address	**Owner**	**On City Water?**	**Comments**
14 Phillips Road (332)	Pat Lawson[a]	Yes	Well casing observed
34 Phillips Road (332)	—	Yes	Well casing, no pump
78 Phillips Road (332)	—	Yes	10 to 12 years on city water, pump does not work
98 Phillips Road (332)	R.A. Smith[a]	Yes	Well casing, no pump
444 Phillips Road (332)	James Larry, Sr.[a]	Yes	Well casing, no pump, well is capped
578 Phillips Road (332)	John Larry[a]	Yes	Well casing observed, well is capped
50 Phillips Road (330)	—	Yes	17 years on city water, well is capped
114 Phillips Road (330)	O'Neal	Yes	20 years on city water, well is capped
328 Phillips Road	Barton Truck	Yes	No wells
867 Phillips Road (326)	—	Yes	No known wells
28 Phillips Road	BPS	Yes	No production wells
876 Old Little Rock Road	—	Yes	No well
6962 Old Little Rock Road	—	Yes	On city water, no motor on pump
7122 Old Little Rock Road	—	Yes	No wells
—	Steel Sales	Yes	No wells
7994 Old Little Rock Road	-	Yes	No wells
8102 Old Little Rock Road	-	Yes	No wells

Notes:

— = No Data Available

a = Information regarding wells these residences was obtained in August 2000. Respondents indicated that water from these wells was no longer used for any purpose.

Agricultural Wells: Data on agricultural wells near the site were obtained from the U.S. Department of Agriculture Soil Conservation Service extension office in Helena, Arkansas. These wells range from 120 to 125 feet deep, and are thus screened in the basal portion of the alluvial aquifer.

Thirteen wells within 1 to 2 miles of the site are used primarily to irrigate cotton fields. However, because crops are rotated in these areas, water from these wells could also be used to irrigate soybean and wheat fields (EnSafe, 1996). There are no data for the agricultural wells. However, sampling of these wells is planned for the 2001. Analytical results and any risks associated with chemicals detected in groundwater will be addressed in an addendum to the risk assessment.

Land-Use Conditions

Land use conditions in the immediate vicinity of the site are either agricultural or industrial (Figure 12). Specifically, the CCC site is bound by Arkansas Highway 242 to the northwest, a Union-Pacific railway to the northeast, and other industrial park properties to the southeast and southwest. The land across Highway 242 is agricultural. Residential areas are within one mile southwest and northeast of the site.

2.3.1.2 Exposure Points

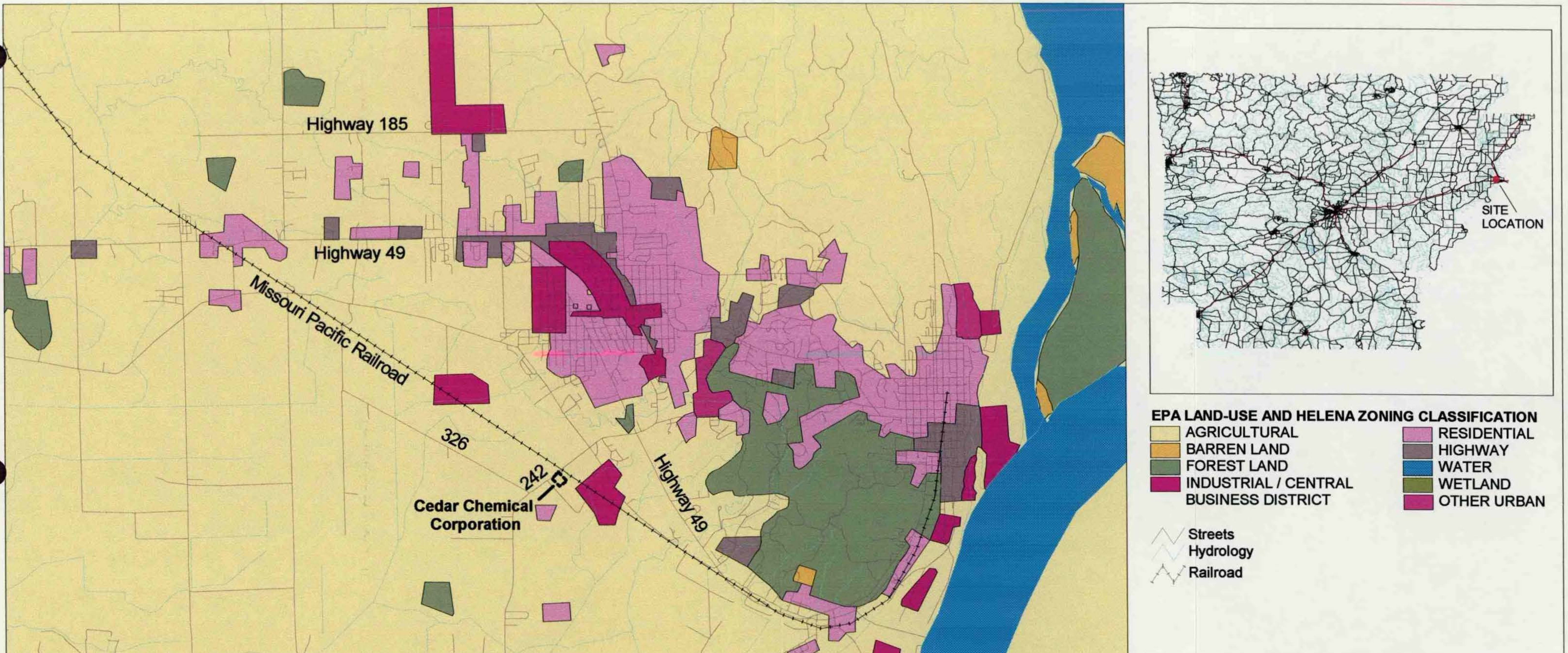
An exposure point is defined as a location of potential contact between a receptor and a chemical. For this risk assessment, it was conservatively assumed that COPCs were uniformly distributed throughout the individual sites. Exposure points identified for CCC are presented below.

Land-Use Scenario	Receptor	Exposure Point
Current/Future Trespasser	Adolescent Trespasser	Surface soil and Sediment
Current/Future Commercial/Industrial	Site Workers	Surface soil and Sediment
Future Commercial/Industrial	Construction Worker	Surface and subsurface soil Perched groundwater
Current/Future Agricultural	Offsite Agricultural Worker	Alluvial groundwater

Site-Specific Exposure Issues — Groundwater

Although alluvial groundwater is considered a drinking water source by ADEQ, it is not currently used for drinking water and no residential wells in the alluvial aquifer have been identified. Currently alluvial groundwater is used for irrigation. All water for human consumption and general use is provided by the water departments for the cities of Helena and West Helena.

Additionally, if agricultural land within this area was changed to residential, new residences would be placed on city water (personal communication, City of Helena Clerk's Office, June 22, 2000).



CEDAR CHEMICAL CORPORATION
WEST HELENA, ARKANSAS

FIGURE 12
LANDUSE AND LANDCOVER MAP

ENSAFE

ENSAFE INC.
ENVIRONMENTAL AND
MANAGEMENT CONSULTANTS

D:/PROJECTS/HELENA_DIR/STATEPLANE/PROJ1.APR

Because alluvial groundwater does not have a direct contact exposure point at the property boundary, it will not be evaluated for a residential land-use scenario.

Site-Specific Exposure Issues — Commercial/Industrial Receptors

There are areas at the site where the only receptors contacting contaminated media are trespassers or maintenance workers. Because there is little default guidance for a maintenance worker scenario, the default site worker scenario was used. Although the site worker scenario does not follow the activity patterns associated with the maintenance worker, the default exposure parameters and assumptions are such that risk is not underestimated. Therefore, the default site worker scenario, which assumes a longer exposure frequency, is more conservative than a maintenance worker scenario would be.

2.3.1.3 Exposure Pathways

Exposure pathways describe modes of contact with an intake of the COPCs at the exposure points. COPC sources, locations, and types of activity patterns are assessed to determine significant pathways of exposure. Relevant pathways for receptors exposed to chemicals detected at CCC are presented below.

Because alluvial groundwater is used to irrigate crops, plants may absorb VOCs during irrigation. Food crops grown on agricultural land adjacent to CCC include soybeans and wheat (EnSafe, 1996). Both crops must be processed before ingestion by humans or animals occurs. Based on information in *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (USEPA, 1998), these crops represent aboveground produce with a protective covering on the edible portions of the plant. This protective covering acts to diminish or inhibit uptake of

Receptors	Medium and Exposure Pathway	Pathway Selected for Evaluation?	Reason for Selection or Exclusion
Current Land Uses			
Site Workers	Air, Inhalation of gaseous contaminants released from soil	Yes	It is assumed that site workers will inhale gaseous contaminants from soil.
	Air, Inhalation of chemicals entrained in fugitive dust	Yes	It is assumed that site workers will inhale fugitive dust.
	Air, Inhalation of gaseous contaminants released from alluvial groundwater	No	Alluvial groundwater is not a water source at CCC.
	Surface Soil, Incidental ingestion	Yes	It is assumed that site workers will ingest incidental amounts of soil.
	Surface Soil, Dermal contact	Yes	It is assumed that site workers will have dermal contact with soil.
Offsite Workers	Air, Inhalation of gaseous contaminants released from alluvial groundwater	No	Alluvial groundwater is not a general or drinking water source at neighboring facilities. Site workers are either not present or within enclosed spaces during irrigation.
Future Land Uses			
Site Workers	Air, Inhalation of gaseous contaminants released from soil	Yes	It is assumed that site workers will inhale gaseous contaminants from soil.
	Air, Inhalation of chemicals entrained in fugitive dust	Yes	It is assumed that site workers will inhale fugitive dust.
	Air, Inhalation of gaseous contaminants released from alluvial groundwater	No	Alluvial groundwater is not a water source at CCC. Site workers are either not present or within enclosed spaces during irrigation.
	Surface Soil, Incidental ingestion	Yes	It is assumed that site workers will ingest incidental amounts of soil.
	Surface Soil, Dermal contact	Yes	It is assumed that site workers will have dermal contact with soil.
Offsite Workers	Air, Inhalation of gaseous contaminants released from alluvial groundwater	No	Alluvial groundwater is not a general or drinking water source at neighboring facilities. Site workers are either not present or within enclosed spaces during irrigation.
Future Onsite Construction Workers	Air, Inhalation of gaseous contaminants released from soil	Yes	It is assumed that construction workers will inhale gaseous contaminants from soil.
	Air, Inhalation of chemicals entrained in fugitive dust	Yes	It is assumed that construction workers will inhale fugitive dust.
	All soil depths, Incidental ingestion	Yes	It is assumed that site workers will ingest incidental amounts of soil.
	All soil depths, Dermal contact	Yes	It is assumed that site workers will have dermal contact with soil.
	Sediment, Incidental ingestion	Yes	It is assumed that site workers will ingest incidental amounts of sediment.
	Sediment, Dermal contact	Yes	It is assumed that site workers will have dermal contact with sediment.
	Perched groundwater, Incidental ingestion	Yes	It is assumed that site workers will ingest incidental amounts of perched groundwater.
	Perched groundwater, Dermal contact	Yes	It is assumed that site workers will have dermal contact with perched groundwater.

Receptors	Medium and Exposure Pathway	Pathway Selected for Evaluation?	Reason for Selection or Exclusion
Future Land Uses (cont.)			
Future Offsite Agricultural Workers	Air, Inhalation of gaseous contaminants released from alluvial groundwater	Yes	It is conservatively assumed that farmers may inhale VOCs emanating from alluvial groundwater.
Future Site Trespassers (Adolescents, 7 through 16 years old)	Air, Inhalation of gaseous contaminants released from soil	Yes	It is assumed that trespassers will inhale gaseous contaminants from soil.
	Air, Inhalation of chemicals entrained in fugitive dust	Yes	It is assumed that trespassers will inhale fugitive dust.
	Surface Soil, Incidental ingestion	Yes	It is assumed that trespassers will ingest incidental amounts of soil.
	Surface Soil, Dermal contact	Yes	It is assumed that trespassers will have dermal contact with soil.
	Sediment, Incidental ingestion	Yes	It is assumed that trespassers will ingest incidental amounts of sediment.
	Sediment, Dermal contact	Yes	It is assumed that site workers will have dermal contact with sediment.

environmental agents via deposition. For these plants, the principal mechanism for plant uptake of VOCs is via vapor transfer. Although there are other mechanisms for contaminant uptake, e.g., root uptake and direct deposition of particles, these processes are not important for this scenario because contamination does not occur in soil and any VOCs in irrigated water are lost to volatilization. According to Jeff Yurk, the primary author of this guidance, USEPA assumes plant uptake of VOCs through any pathway (air, deposition, or roots) to be insignificant, because VOCs have low bioaccumulation factors and VOC levels are reduced during processing of crops after harvest. Therefore, risks associated with ingestion of contaminated produce were not evaluated for CCC.

2.3.2 Fate and Transport Modeling

Concentrations of airborne chemicals from soil were estimated using mathematical models to approximate fate and transport processes in the ambient environment.

Air Concentrations of VOCs and Particulates

Airborne chemicals from soil were evaluated as VOCs and fugitive dust. Concentrations of volatiles from soil were calculated using methods outlined in *Soil Screening Guidance: User's Guide* (USEPA, 1996), which require calculating chemical-specific soil-to-air volatilization factors (VFs). The calculation of VF values was completed using Equations 5 and 6, which are presented on the Soil Screening Level website (http://risk.lsd.ornl.gov/epa/ssl1.htm). The website was also used to calculate VFs. The results of these calculations are presented in Appendix F.

$$VF\left(m^3/kg\right) = \frac{Q/C \times \left(3.14 \times D_A \times T\right)^{1/2} \times 10^{-4}\left(m^2/cm^2\right)}{2 \times \rho_b \times D_A} \qquad \text{Equation 5}$$

where:
$$D_A = \frac{\left[\left(\theta_a^{10/3} D_i H' + \theta_w^{10/3} D_w\right)/n^2\right]}{\rho_b K_d + \theta_w + \theta_a H'} \qquad \text{Equation 6}$$

where:

VF	=	volatilization factor (m^3/kg)
Q/C	=	inverse of mean concentration at center acre-square source (37.64 g/m^2-s per kg/m^3 for Little Rock)
D_A	=	apparent diffusivity (cm^2/s) (chemical-specific)
θ_a	=	air-filled soil porosity ($L_{air}/L_{soil} = n - \theta_w = 0.28$)
D_i	=	diffusivity in air (cm^2/s) (chemical-specific)
H'	=	dimensionless Henry's law constant (chemical-specific)
n	=	total soil porosity ($L_{pore}/L_{soil} = 1 - \rho_b/\rho_s = 0.43$)
D_w	=	diffusivity in water (chemical-specific)
K_d	=	soil-water partition coefficient ($cm^3/g = K_{oc} \times f_{oc}$) (chemical-specific)
K_{oc}	=	soil organic carbon partition coefficient (cm^3/g) (chemical-specific)
f_{oc}	=	fraction organic carbon (0.006 g/g)
ρ_b	=	dry soil bulk density (1.5 g/cm^3)
ρ_s	=	soil particle density (2.65 g/cm^3)
T	=	exposure interval (9.5E+08s)
θ_w	=	water-filled soil porosity (0.15 L_{water}/L_{soil})

The rate of fugitive dust emission from the soil surface depends upon various factors, including surface roughness and cloddiness, surface soil moisture content, type and amount of vegetative cover, wind velocity, etc. Concentrations of chemicals in fugitive dust particles from soil were calculated using the default particulate emission factor of 1.32E+09 m^3/kg which is presented in *Soil Screening Guidance: User's Guide* (USEPA, 1996).

Air Concentrations of VOCs in Alluvial Groundwater

Air concentrations associated with irrigation were estimated for COPCs in alluvial groundwater using the mathematical model described in Equations 7 to 9. These air concentrations were conservatively estimated based on exposure to one square acre of land at a temperature of 80°F and a wind speed of 1 m/sec. It is assumed that the land is supplied with an inch of water (102,800 liters) on a given day and that the contaminated water is supplying a constant molar flux from the water to the air over the square acre. The following equation, a solution of Fick's law, was used to calculate the molar flux.

$$N_A = \frac{P \times D_{AB}\,(p_{A1} - p_{A2})}{(z_2 - z_1)\,RT\,(p_B)_{lm}} \qquad \text{Equation 7}$$

where:

N_A	=	Molar Flux of 2-propanol (moles per square feet per pound [moles/ft^2 - lb])
P	=	Total pressure of system [14.7 pounds per square inch (psi)]
D_{AB}	=	Diffusion coefficient for each VOC (A) in air (B) (≅ 1E-05 square meters per second [m^2/sec])
p_{A1}	=	Partial pressure of VOC at point 1
p_{A2}	=	Partial pressure of VOC at point 2 (0 psi)
$(p_b)_{lm}$	=	Log mean of air pressure
z_2	=	Point 2 in feet (5 millimeters [mm])
z_1	=	Point 1 starting point of liquid (0 mm)
R	=	Gas Constant 10.73 (cubic feet-pounds per square inch/pound-mole-°Rankine
T	=	Temperature °R (80 °F)

The vapor pressure for each VOC was calculated using Henry's law, as described by Equation 8.

Equation 8

$$P_{vp} = H_c \times C_w$$

where:

P_{vp} = Air vapor pressure (psi)
H_c = Henry's law constant (chemical-specific)
C_w = Concentration in water (milligrams per liter [mg/L])

The Henry's law constants were collected from the literature (Sawyer, 1994; Davis, 1998; DOE Risk Assessment Information System, http://risk.lsd.ornl.gov/rap_hp.htm). Air vapor pressure (P_{vp}) estimated using Equation 8 was substituted for P_{A2} in Equation 7.

USEPA's Screen Model Version 3 modeling was performed on each of the emission rates generated above to determine the maximum downwind concentrations. The maximum concentration predicted by this dispersion model are presented in Table 34.

2.3.3 Potentially Exposed Populations

The known or potential human receptors for current and future land use conditions include:

Current Land Use	Future Land Use
Onsite Workers	Construction Worker
Offsite Agricultural Worker	Adolescent Trespasser
	Offsite Agricultural Worker
	Onsite Workers

Although there is the possibility that industrial workers and future residents located on property adjacent to CCC may be exposed to volatile contaminants emanating from groundwater during irrigation events, potential risks associated with these receptors are substantially lower than for the agricultural worker because residential receptors and workers are either in enclosed spaces or not present during irrigation. Therefore, risks to these receptors were not evaluated.

It is unlikely that the surrounding property will be developed for residential use in the foreseeable future based on census data presented below for the cities of Helena and West Helena (U.S. Department of Commerce, 2000). Population estimates for the years 1990 to 1998, which are presented below, indicate that neither city will experience drastic increases in population. Therefore, it is not likely that county agricultural land will be required for additional housing units.

Population Estimates for Places: Annual Time Series, July 1, 1990, to July 1, 1998										
	Estimated Population									
	7/1/98	**7/1/97**	**7/1/96**	**7/1/95**	**7/1/94**	**7/1/93**	**7/1/92**	**7/1/91**	**7/1/90**	**4/1/90**
Helena	6,970	7,081	7,069	7,158	7,237	7,261	7,279	7,307	7,475	7,491
West Helena	9,443	9,576	9,639	9,742	9,835	9,841	9,855	9,896	10,114	10,137

***Source*:**
Population Estimates Program, Population Division, U.S. Census Bureau, Washington, DC 20233 (Internet Release Date: June 30 1999).

2.3.4 Quantification of Intakes

Estimates of exposure to COPCs are required for quantitative risk characterization. The basic equation used to calculate human intake is as follows:

$$Intake = C \times \frac{KR \times EF \times ED}{BW \times AT} \qquad \text{Equation 9}$$

where:

Intake	=	daily intake (milligrams per kilogram per day [mg/kg-day])
C	=	concentration of the chemical (e.g., milligram per kilogram [mg/kg] in soil, milligrams per liter [mg/L] in water or milligram per cubic meter [mg/m^3] in air)
KR	=	contact rate; the amount of contaminated medium contacted over the exposure period (e.g., milligram per day [mg/day] for soil, liters per day [L/day] for water, and cubic meters per day [m^3/day] for air)
EF	=	exposure frequency; describes how often exposure occurs (days/year)
ED	=	exposure duration; describes how long exposure occurs (years)
BW	=	body weight; the average body weight over the exposure period (kilograms [kg])
AT	=	averaging time; period over which exposure is averaged (days)

Each of the intake variables in Equation 9 have a range of values. The intake model variables used generally reflect 50th or 95th percentile values which, when applied to the exposure point concentration (EPC), ensure that the estimated intakes represent the reasonable maximum exposure (RME). Formulas were derived from RAGS, Part A unless otherwise indicated.

The pathway-specific intake formulas, variables, and calculations are presented for each receptor. For the adult worker, trespasser, construction worker, and offsite agricultural worker two different types of tables are presented. The first presents the formula, assumed input values, associated references, and relevant comments. This table should be consulted for details and rationale regarding the parameter values used in the calculations. Each variable table is immediately followed by tables presenting the actual calculations using the information in the variable table. For clarity, each variable of the intake equation is included in the calculation tables. The tables are numbered as follows:

	Soil	Sediment	Groundwater
Construction Worker	Tables 35-38	Tables 39-41	Tables 42-44
Site Worker	Tables 45-48	NA	NA
Adolescent Trespasser	Tables 49-52	Tables 53-55	NA
Offsite Agricultural Worker	NA	NA	Tables 56-57

Because site worker exposure at Site 4 differs from all other CCC sites, the exposure parameters used to develop pathway-specific intake factors were adjusted to account for site-specific exposure patterns. For Site 4, it was assumed that the workers were exposed only during shipping and receiving activities. Tables outlining pathway-specific intake formulas, variables, and calculations are presented in Appendix G.

2.4 Toxicity Assessment

The objectives of the toxicity assessment are to evaluate the potential for particular contaminants to cause adverse effects in exposed individuals and to provide the analytical framework for the characterizing human health impacts.

2.4.1 Toxicological Information for Noncarcinogenic Effects

To assess noncarcinogenic risks, the USEPA has adopted the science policy position that protective mechanisms such as repair, detoxification, and compensation must be overcome before the adverse health effect is manifested. Therefore, a range of exposures exists from zero to some finite value that can be tolerated by an organism without appreciable risk of expressing adverse effects.

USEPA gauges potential noncarcinogenic effects by identifying the upper boundary of the tolerance range (threshold) for each chemical and deriving an exposure estimate below which adverse health effects are not expected to occur. Such an estimate for the oral exposure route is called an oral reference dose (RfD); for the inhalation exposure route it is an inhalation reference concentration (RfC). The oral RfD is typically expressed as milligrams (mg) chemical per kilograms (kg) body weight per day, and the inhalation RfC is usually expressed as concentrations in air (i.e., mg chemical per m^3 of air). However, for this risk assessment, inhalation RfC values can be converted to dosage units by multiplying them by the inhalation rate (20 m^3/day, an upper-bound estimate for combined indoor-outdoor activity) and dividing by the body weight (70 kg, average adult body weight):

$$RfD_{inhalation} = \frac{RfC \times IR_{inhalation}}{BW} \qquad \text{Equation 10}$$

where:

$RfD_{inhalation}$	=	Inhalation reference dose (mg/kg-day)
RfC	=	Reference concentration (mg/m^3)
$IR_{inhalation}$	=	Inhalation rate (m^3/day)
BW	=	Body weight (kg)

Two types of oral RfDs/inhalation RfCs are available from the USEPA; which are based on length of exposure. Chronic oral RfDs/inhalation RfCs are specifically developed to protect against long-term exposure to a compound, and are generally used to evaluate the noncarcinogenic effects associated with exposure periods between seven years (approximately 10% of a human lifetime) and a lifetime. Subchronic oral RfDs/inhalation RfCs are useful for characterizing potential noncarcinogenic effects associated with shorter-term exposures. As a current guideline for Superfund program risk assessment, subchronic oral RfDs/inhalation RfCs are used to evaluate potential noncarcinogenic effects of exposure periods between two weeks and seven years.

The toxicological criteria used to evaluate the noncarcinogenic health effects potentially associated with exposure to chemicals of concern are presented in Tables 58 (oral route) and Table 59 (inhalation route). Relevant information, such as most sensitive target organs and/or systems, uncertainty factors used as basis for the derivation of toxicological criteria, and information sources, are also included.

No toxicological criteria are currently available to gauge potential human health concerns associated with the dermal exposure route. For risk assessment purposes, oral RfDs are recommended as the default dermal RfDs (USEPA 1989a), if:

- Health effects following exposure are not route-specific.
- Portal-of-entry effects (e.g., dermatitis from dermal exposure and respiratory effects from inhalation exposure) are not the principal effects of concern.

Exposure through the dermal route is generally calculated as an absorbed dose, while oral RfDs are expressed as administered doses. Therefore, adjustments are necessary to match the dermal exposure estimates with the oral RfDs. Current USEPA Superfund guidance is to adjust the oral RfD with an oral absorption factor (i.e., percentage of the chemical absorbed) to extrapolate a default dermal RfD, which is expressed in terms of absorbed dose. The equation for extrapolation of a default dermal RfD is:

$$RfD_{dermal} = RfD_{oral} \times Oral\ Absorption\ Factor \qquad \text{Equation 11}$$

where:

RfD_{dermal}	=	Dermal reference dose (absorbed dose in mg/kg-day)
RfD_{oral}	=	Oral reference dose (administered dose in mg/kg-day)

The default dermal RfDs and the oral absorption factors used in calculations are presented in Table 58.

2.4.2 Toxicological Information for Carcinogenic Effects

To assess risks associated with potential carcinogens, the USEPA has adopted the science policy position of "no-threshold," i.e., there is essentially no level of exposure to a carcinogen that will not result in some finite possibility of tumor formation.

The USEPA has formed a Carcinogen Risk Assessment Verification Endeavor (CRAVE) work group. Its purpose is to evaluate the weight of evidence using available carcinogenicity data to estimate excess lifetime cancer risks from various levels of exposure to potential human carcinogens by establishing weight-of-evidence classifications and developing numerical carcinogenic risk estimates (slope factors or unit risks).

The weight-of-evidence classification assigned to a potential carcinogen by USEPA estimates of the likelihood that an agent is a human carcinogen, based on best professional judgment of the quality of available data. The classification does not affect numerical carcinogenic estimates. USEPA classifications are outlined below:

> ***Group A chemicals (human carcinogens):*** There is sufficient evidence to support a causal association between human exposure and cancer.
>
> ***Groups B1 and B2 chemicals (probable human carcinogens):*** There is limited (B1) or inadequate (B2) evidence of carcinogenicity based on human studies. Group B2 agents are also generally supported by carcinogenicity data in animal studies.
>
> ***Group C chemicals (possible human carcinogens):*** There is limited evidence of carcinogenicity in animals.

Group D chemicals (i.e., not classifiable as to human carcinogenicity): These are chemicals for which there is inadequate human and animal evidence of carcinogenicity, or for which no data are available. Numerical carcinogenic risk estimates are not typically calculated for Group D chemicals because of the lack of pertinent dose-response data.

Group E chemicals (i.e., evidence of non-carcinogenicity in humans): There is no evidence of carcinogenicity from adequate human or animal data.

Two types of quantitative estimates are available from CRAVE for evaluating carcinogenic potency associated with oral exposure: slope factor, expressed in terms of risk per unit dose (as units of $[mg/kg\text{-}day]^{-1}$), and unit risk, expressed as risk per unit concentration in drinking water (micrograms per liter $[\mu g/L]^{-1}$).

Inhalation unit risks (an expression of carcinogenic risk per unit concentration in air) are verified by USEPA's CRAVE work group as a numerical estimate of the carcinogenic risks associated with inhalation exposure to carcinogens. The inhalation slope factors (an expression of carcinogenic risk per unit dose) calculated by the USEPA were removed from the Integrated Risk Information System (IRIS) in January 1991 because CRAVE believed that the concentration in air, rather than the total body dose, was a better index of inhalation exposure. To facilitate quantitative risk assessment, the current Superfund guidance is to convert an inhalation unit risk to a body dose, as directed in the Health Effects Assessment Summary Tables (HEAST), by using the following equation:

$$SF_{inhalation} = \frac{UR_{inhalation} \times BW \times CF}{IR_{inhalation}} \qquad \text{Equation 12}$$

where:

$SF_{inhalation}$	=	Inhalation slope factor $(mg/kg\text{-}day)^{-1}$
$UR_{inhalation}$	=	Inhalation unit risk (micrograms per cubic meter $[\mu g/m^3]^{-1}$)
$IR_{inhalation}$	=	Upper bound estimate of inhalation rate (20 m^3/day)
CF	=	Conversion factor (micrograms per milligram [μg/mg])

Toxicological information for the carcinogenic health concern related to the chemicals selected for the quantitative risk assessment is presented in Table 60 (oral route)and Table 61 (inhalation route). These tables present carcinogenic weight-of-evidence classifications, quantitative cancer potency estimates (i.e., oral slope factors and inhalation unit risks), primary tumor sites that have been reported, and information sources.

Current USEPA Superfund guidance for calculating a dermal slope factor is to adjust the oral slope factor with an oral absorption factor specific to that chemical, using the following equation:

$$SF_{dermal} = \frac{SF_{oral}}{Oral\ Absorption\ Factor} \qquad \text{Equation 13}$$

where:

SF_{dermal}	=	Dermal slope factor $(mg/kg\text{-}day)^{-1}$
SF_{oral}	=	Oral slope factor $(mg/kg\text{-}day)^{-1}$

The default dermal slope factors for the chemicals of concern, along with the oral absorption factors used are presented in Table 60.

2.5 Risk Characterization

This step of the risk assessment integrates information from the exposure and toxicity assessments (Sections 3 and 4) to characterize potential risks posed by site COPCs.

Risk characterization methodology follows these steps:

- Organize exposure and toxicity assessments outputs by the duration and exposure route for each population.

- Quantify total carcinogenic and noncarcinogenic risks for each pathway by summing the estimated risks estimated for each COPC.

- Estimate overall risks affecting each population over the same time period by combining risks across pathways.

- Analyze and discuss inherent risk characterization uncertainties.

2.5.1 Quantification of Noncarcinogenic Risk

Noncarcinogenic risk is expressed as an HQ, which is the ratio of the exposure intake (calculated in the exposure assessment) over the reference dose (acceptable intake indicated by oral RfD or inhalation reference value from the toxicity assessment). An HQ less than or equal to 1 indicates that an individual is unlikely to experience adverse health effects from exposure to the COPC (USEPA, 1989). The HQ is calculated as follows:

$$HQ = \frac{DI}{RfD} \qquad \text{Equation 14}$$

where:

HQ	=	hazard quotient (unitless)
DI	=	daily intake (mg/kg-day)
RfD	=	reference dose (mg/kg-day)

A hazard index (HI) is calculated by summing the HQs to address noncarcinogenic additive effects between chemicals and cumulative effects across all exposure routes.

2.5.2 Quantification of Carcinogenic Risk

Carcinogenic risk is characterized by calculating a CR probability. The CR is a unitless incremental probability of an individual developing cancer from a lifetime exposure to a COPC (USEPA, 1989). For low risk levels (below estimated risk of 0.01), the CR is calculated by multiplying the exposure intake (calculated in the exposure assessment) by the cancer slope factor (from the toxicity assessment). The criterion typically used by regulatory agencies for demonstration of no carcinogen risk of concern is a CR of less than one in a million. A CR is calculated as follows:

$$CR = DI \times SF \qquad \text{Equation 15}$$

where:

CR = cancer risk (unitless)
DI = daily intake (mg/kg-day)
SF = slope factor $(\text{mg/kg-day})^{-1}$

To address multiple chemicals, the additive carcinogenic effects of chemicals and cumulative effects across all routes of exposure were addressed by summing the individual CRs.

$$CR_{SITE} = CR_{PATHWAY_A} + CR_{PATHWAY_B} + CR_{PATHWAY_C} \cdots \qquad \text{Equation 16}$$

where:

CR_{SITE} = Sum of cancer risk calculated for COPCs in each pathway
$CR_{PATHWAY}$ = Cancer risk for each applicable exposure pathway

2.5.3 Results of Risk Characterization

Results of the risk characterization are presented for each land-use condition and exposure pathway in the following tables in Appendix A:

Site	Tables
1	62A-64E
2	65A-67C
3	68A-69C
4	70A-72C
6	73A-75C
9	76A-78C
Offsite	79A-79C

2.5.3.1 Discussions of Risk Characterization

Regulatory agencies have developed criteria for the demonstration of carcinogenic and noncarcinogenic risks. A CR ranging between one in one million (1×10^{-6} or 1E-06) and one in ten thousand (1×10^{-4} or 1E-04) is currently used by USEPA as the target risk level for carcinogenic effects, whereas an HI of 1 is used as the target risk level for noncarcinogenic effects. Tables 80 to 83 summarize those carcinogenic and noncarcinogenic risks exceeding 1E-06 and 1 for each site and receptor.

Except for alluvial groundwater exposure for the offsite agricultural worker carcinogenic risk for the remaining media (perched groundwater, sediment and soil) have cumulative CRs that are less than 1E-04. The site worker, construction worker, and trespasser carcinogenic risks are less than 1E-04.

Groundwater carcinogenic risk for alluvial groundwater is 7E-04. The primary contributors to cancer risk are 1,2-dichloroethane (5E-04) and methylene chloride (2E-04).

Tables 80 to 83 summarize the noncarcinogenic risks exceeding unity for each receptor. HIs for several sites exceed unity, suggesting that COPCs may pose adverse noncarcinogenic impact to receptors evaluated in the HHRA.

The construction worker (Table 80) soil exposures exceed unity for perched groundwater and at Sites 2, 3, 4, and 9. The primary contributor to the soil HQ is Dinoseb (Sites 3, 4, and 9) and 1,2-dichloroethane at Site 2. 3,4-Dichloroaniline, 4-chloroaniline, 1,2-dichloroethane, and methylene chloride are the primary contributors to HQ for perched groundwater.

Table 81 lists the noncarcinogenic risks exceeding unity for the adult worker exposure to surface soil. At Site 9 Dinoseb is the primary contributor to noncarcinogenic risk.

Table 82 presents noncarcinogenic risks exceeding 1 for the trespasser. Site 9 is the only site with unacceptable noncarcinogenic risk. The primary contributors are Dinoseb and Propanil.

Table 83 presents those noncarcinogenic risks exceeding unity for the offsite agricultural worker exposure to airborne VOCs released from alluvial groundwater. 1,2-Dichloroethane, chloroform, and toluene are the primary contributors to noncarcinogenic risk.

2.5.4 Chemicals of Concern Identified by Site and Media

A contaminant was selected as a COC if its CR exceeded 1E-6 or it had an HQ greater than 1. COCs are listed below by site and media:

Site	Surface Soil	Subsurface Soil	Sediment
1	None	None	Arsenic
2	None	1,2-Dichloroethane	NA
3	NA	Dinoseb	None
4	None	3,4-Dichloroaniline, Dinoseb	NA
6	None	NA	NA
9	Dinoseb, Propanil	Dinoseb, Propanil	NA
Perched Groundwater		4-Chloroaniline, 3,4-Dichloroaniline, 1,2-Dichloroethane, Methylene chloride	
Alluvial Groundwater		Benzene, Chloroform, Methylene Chloride, 1,2-Dichloroethane, 1,1,2-Trichloroethane, and Toluene	

2.5.5 Central Tendency Evaluation

Where RME estimates of risk indicated a significant threat (CR greater than 1E-4 or an HQ greater than 1) would be posed to human health, central tendency (CT) analysis was performed. The CT analysis uses the arithmetic mean concentration as the EPC and 50th percentile exposure assumptions that are consistent with guidance provided in *Exposure Factor's Handbook* (USEPA, 1997). Central tendency exposures are presented for comparison to risks associated with RME exposure.

A CT evaluation was completed for the following sites, media, and chemicals.

Receptor	Site	Media	Chemicals
Construction Worker	1 and 2	Perched Groundwater	4-Chloroaniline, 3,4-Dichloroaniline, 1,2-Dichloroethane, Methylene chloride
	3	Surface and Subsurface Soil	Dinoseb
	4	Surface and Subsurface Soil	3,4-Dichloroaniline, Dinoseb
	9	Surface and Subsurface Soil	3,4-Dichloroaniline, Dinoseb, Propanil
Adult Worker	9	Surface Soil	Dinoseb, Propanil
Trespasser	9	Surface Soil	Dinoseb, Propanil
Offsite Agricultural Worker	—	Alluvial Groundwater	Methylene chloride, 1,2-Dichloroethane, Toluene

Tables 84 to 90 summarize present risks calculated for CT exposure. Intake factor calculations used to develop the CT exposure are presented in Appendix G.

Construction Worker

Tables 84A to 84C present the noncarcinogenic and carcinogenic risks for the construction worker exposed to perched groundwater. Using CT exposure assumptions, carcinogenic risks are below threshold levels. Noncarcinogenic risk to 3,4-dichloroaniline remain greater than 1.

Tables 85A to 85C present the noncarcinogenic risks for the construction worker exposed to Dinoseb in subsurface soil at Site 3. Noncarcinogenic risk has been reduced to less than 1 using CT exposure assumptions.

Tables 86A to 86C present the noncarcinogenic risks for the construction worker exposed to 3,4-dichloroaniline (9) and Dinoseb (3) in surface and subsurface soil at Site 4. Using CT exposure assumptions noncarcinogenic risks remain above 1.

Tables 87A to 87C present the noncarcinogenic risks for the construction worker exposed to 3,4-dichloroaniline, Dinoseb, and Propanil in Site 9 surface and subsurface soil. Using CT exposure assumptions noncarcinogenic risks are less than 1.

Adult Worker

Tables 88A to 88C present the noncarcinogenic risk for the adult worker exposed to Dinoseb in Site 9 surface soil. Using CT exposure assumptions, noncarcinogenic risks remain greater than 1.

Trespasser

Tables 89A to 89C present the noncarcinogenic risks for the trespasser exposed to Dinoseb and Propanil in Site 9 surface soil. Using CT exposure assumptions, noncarcinogenic risks are less than 1.

Offsite Agricultural Worker

Tables 90A to 90C present the noncarcinogenic and carcinogenic risks for the offsite agricultural worker exposed to VOCs released from alluvial groundwater during irrigation. Using CT =exposure assumptions, noncarcinogenic risks are less than 1. Carcinogenic risk is 3E-05 and the primary contributor to risk is 1,2-dichloroethane. However, the risk of 5E-05 is within the USEPA threshold range of 1E-06 to 1E-04.

2.5.6 Discussion of Uncertainty

2.5.6.1 Data Evaluation Uncertainties

A conservative approach was used to review available analytical data and select COPCs for the quantitative risk assessment. The selection of a compound as a COPC does not necessarily suggest that it poses a human health or environmental concern for the site under investigation. Inclusion of a chemical in the quantitative risk assessment only indicates a need for further examination of the compound determine if there are any risks from exposure to this chemical.

Three background surface soil samples were collected at CCC. Because of the lack of information associated with background metals concentrations, it is unknown whether lead should be a COC. The lack of data identifying the naturally occurring levels of arsenic in native soil and lead in alluvial groundwater upgradient of CCC represents a data gap and could lead to an overestimate of risk.

Concentrations used in the risk assessment were conservatively determined. It was assumed that the chemicals in soil occurred uniformly on ground surface. Because of this conservative approach, actual site risks are expected to be substantially lower than those risks estimated in this risk assessment.

2.5.6.2 Exposure Assessment Uncertainties

Uncertainties in the exposure assessment could arise from the following sources:

- Use of standard assumptions instead of site-specific data selected on the basis of "best professional judgment."

- Selection of a value from a wide range reported in published literature thought to best represent the site under study.

- The degree of "protectiveness" or "conservatism" inherent in the current risk assessment guidance.

- Lack of sufficient data and necessary assumptions made in order to complete the quantitative risk assessment.

The types and sources of exposure uncertainties are outlined below.

Calculation of Exposure Point Concentrations

A conservative approach was used to estimate the concentrations at the point of exposure, not considering degradation of any chemicals in the environmental media. Because it has been well recognized that many organic chemicals can degrade in the environment, this conservative approach is expected to result in an overestimate of risk.

Selection of Exposure Pathways

Although not considered likely in the actual environmental situation, it was assumed that the population of concern could simultaneously be exposed to multiple chemicals through all possible pathways. This conservative assumption is anticipated to overestimate potential site risks.

Exposure Parameter Values for Each Pathway

To conduct a quantitative exposure assessment, many assumptions must be made concerning the exposure scenarios (e.g., frequency and duration of exposure, intake rate of contaminated media). Site-specific values are often unavailable and the using default values (primarily upper-bound estimates) is likely to contribute to exposure assessment uncertainty. For the hypothetical future scenarios (i.e., industrial and residential exposures), default values used in the exposure assessment are worst-case values and overestimate exposure. Summarized below are examples of uncertainties related to the selection of parameter values:

Soil Inhalation Pathway

Inhalation rate (the volume of air inhaled per unit period of time) can vary according to an individual's age, weight, sex, activity level and general physical condition. In accordance with USEPA guidance (USEPA, 1991), the default inhalation rate of 20 m^3/day or 0.83 m^3/hr was used in the risk assessment for adult receptors. This value is considered to be an upper-bound value for adults representing inhalation during active hours. Values of 13.3 m^3/day (equivalent to 0.55 m^3/hr) and 8.7 m^3/day (equivalent to 0.36 m^3/hr) are recommended, respectively, by USEPA as the average daily inhalation rate for adults and children (between ages of 1 and 12) for continuous exposure in which specific activity patterns are not known (USEPA, 1997). Therefore, use of the default value is expected to overestimate potential inhalation risk.

Ingestion Pathway

In accordance with USEPA guidance (USEPA, 1991), the following combined soil and dust ingestion rates were used in this risk assessment: 50 mg/day (for adolescent trespassers and site workers) and 480 mg/day (for construction workers). The text below outlines the uncertainties associated with each value.

Construction Workers

There are no reliable data for estimating adult soil ingestion rates. The 480 mg/day ingestion rate recommended by Hawley used to estimate RME is based on adults working in a dusty environment such as an attic. This value is based on conjecture rather than empirical data. Therefore, the uncertainties associated with the use of this value are unknown. A soil ingestion rate of 50 mg/day for adults in a commercial/industrial setting is recommended as a standard default value (USEPA,1991), based on a preliminary adult soil ingestion study by Calabrese (1991). Although this soil ingestion study is limited by the number of participants, it is the recommended USEPA value. Additionally, Calabrese and Stanek have since determined that the soil ingestion rates reported in their preliminary study were invalid, and that the previously derived ingestion rate of 50 mg/day is an overestimation. They estimate that the value is most likely closer to an ingestion rate of 10 mg/day (Calabrese and Stanek, 1991).

The *Exposure Factors Handbook* does not recommend a separate CT ingestion rate for an adult or construction worker. For this HHRA, the default adult ingestion rate was used as the CT ingestion rate. Because the construction worker's environment is dustier than that of the default site worker, the CT construction worker ingestion pathway was evaluated assuming an ingestion rate of 75 mg/day, 100 mg/day, and 240 mg/day. CT noncarcinogenic risk estimated using the higher ingestion rate values are summarized below. A detailed presentation of the calculations and results is provided in Appendix J.

	Site 3				Site 4				Site 9			
Ingestion Rate (mg/day)	50	75	100	240	50	75	100	240	50	75	100	240
Chemical of Concern	**Noncarcinogenic Risk for the Ingestion Pathway**											
Dinoseb	0.11	0.16	0.22	0.52	0.1	0.14	0.02	0.046	0.21	0.316	0.42	1
3,4-Dichloroaniline	NA	NA	NA	NA	0.016	0.024	0.03	0.078	0.13	0.13	0.13	0.13
Propanil	NA	NA	NA	NA	NA	NA	NA	NA	0.003	0.005	0.007	0.017

Note:
NA = Not a COC at this site.

Except for Dinoseb at Site 9, the noncarcinogenic risks remain below 1 as the ingestion rate increases to 240 mg/day. For Site 9 the total noncarcinogenic risk for all exposure pathways is 1, which is still within USEPA's acceptable range. Therefore, using the 50 mg/day ingestion rate is not likely to underestimate risks associated with the construction worker's ingestion exposure.

Trespassers

USEPA does not provide default soil ingestion values for a trespassing scenario. In the absence of this information, the soil and sediment ingestion rate was estimated to be 50 mg/day.

In summary, the soil ingestion rates currently recommended by USEPA (i.e., 50 mg/day for adolescent trespassers and adults in a commercial/industrial environment and 480 mg/day for construction workers) are overly conservative and not supported by the scientific literature. Therefore, use of these default soil ingestion rates in the site-wide risk assessment is expected to result in an overestimation of risk.

Dermal Pathway

Exposed Skin Area — The amount of chemical intake correlates directly with the exposed skin surface area. Climatic conditions could determine the type of clothing worn, and thus the skin area exposed. USEPA currently recommends that 5% of the skin is exposed during winter, 10% during spring and fall, and 25% during summer (USEPA, 1996b). Assuming an adult body surface area of 20,000 cm^2, exposed skin surface areas would be: 1,000 cm^2 in winter, 2,000 cm^2 in spring and fall, and 5,000 cm^2 in summer.

For CCC exposed skin surface areas of 2,900 cm^2 and 4,100 cm^2 were selected for evaluating dermal exposures to soil for a child and adult (residential and industrial) populations. These values represent 20% of the body surface, assuming an individual is wearing a short-sleeved shirt, long pants, and shoes with only the head (1,400 cm^2), hands (1,120 cm^2), and forearms (1,570 cm^2) exposed. For the trespasser, the exposed skin surface is assumed to be 2,900 cm^2. This is based on 20% of the total body surface for an adolescent ages 7 to 16 years old. The values used are conservative for these scenarios.

Soil-to-Skin Adherence Factor (AF) — A default AF value of 1 mg/cm^2 is recommended by USEPA for estimating intake of chemicals in soil via dermal exposure route (USEPA, 1995). This value was first provided in a USEPA report as an upper-bound estimate (USEPA, 1992a). Available studies indicate that adherence levels vary considerably with the type of activities and across different parts of the body (USEPA, 1997). Because the AF was not adjusted to account for these variables, risk associated with dermal contact exposure is most likely overestimated.

Absorption Factor (ABS) — Very limited information is available concerning dermal absorption of chemicals from contaminated soil under realistic environmental conditions. In fact, there are no actual epidemiological data to support the current USEPA position that absorption of soil-bound organics under realistic exposure conditions constitutes a complete pathway.

Region IV USEPA (USEPA, 1995a) requires that ABS values be based on the following default values: organics, 1 percent and inorganics: 0.1 percent. For the development of Region VI MSSLs, ABS values of 10 percent for organics and 1 percent for inorganics are used. It should be emphasized that information to support chemical-specific ABS is only available for the following chemicals: cadmium: 1 percent; PCBs: 6 percent; TCDD: 3 percent (low organic soil) and 0.1 percent (high organic soil); other dioxins: 3 percent (USEPA, 1992a). According to the *Soil Screening Guidance* (USEPA, 1996c), pentachlorophenol is the only chemical among the 110 compounds evaluated to show greater than 10 percent dermal absorption. Therefore, quantification of dermal pathways has been deferred in several USEPA documents (USEPA, 1992a, 1996b) pending development of adequate data and methodology.

Because the ABS values suggested by Region VI USEPA are considered to be highly conservative in light of existing data, these recommended ABS values were not used in this risk assessment to calculate chemical intake in soil through direct dermal contact. Region IV USEPA ABS values were considered to be comparable to the values presented most recently in the literature. The ABS database for chemicals encountered as media contaminants is limited; therefore, using these default values could overestimate or underestimate risk associated with dermal exposure.

Groundwater Inhalation Pathway

Exposure Frequency: Inhalation of VOCs from groundwater for the offsite agricultural worker is a site-specific exposure pathway. The exposure frequency represents the number of irrigation events during a growing season. Information from the Phillips County Cooperative Extension Service indicates that irrigation occurs 7 to 10 days per month (average 8.5 days) during a growing season which begins in late April and ends in September. Assuming crops are irrigated 2.1 days in April and 8.5 days for the remaining months, the total irrigation events per year is 44.6 days.

The number of irrigation events depends on climate and the type of crop irrigated. Some crops might require more irrigation during the growing season than others, suggesting that the EF selected may result in an overestimate of risks to agricultural workers.

Exposure Time: The exposure time represents the time the agricultural worker is present during irrigation events. Because this is a site-specific scenario, limited information is available to address this parameter. However, it was conservatively assumed that the agricultural worker would be present four at least 4 hours during irrigation events. Generally, irrigation systems are automated and do not require the presence of an operator during operation. Most systems are put into operation and the agricultural worker then leaves the field. Therefore risks associated with this exposure time are most likely overestimated.

Concentration in Air: Mathematical models were used to estimate the concentrations of VOCs released from groundwater during irrigation. The groundwater concentrations used for modeling are from wells installed both on the CCC property and just beyond the property boundary. No samples were collected from the agricultural wells used for irrigation because the wells appeared to be outside the contaminant plume and samples were initially collected only to determine the nature and extent of contamination. Also, samples collected from agricultural wells were not likely to be usable for the nature and extent evaluation unless the wells were modified for

VOC collection. For the HHRA, it was assumed that contaminants would move downgradient of the site, resulting in contamination of the agricultural wells. Because it is unknown if these contaminants are undergoing natural attenuation, the concentrations used for this model may overestimate risk. The lack of VOC data from the agricultural wells is a data gap. However, the relevant downgradient agricultural wells will be sampled and the risk associated with VOCs present in this water will be evaluated as necessary.

2.5.6.3 Toxicity Assessment Uncertainties

Uncertainties in the quantitative toxicity assessment are well recognized, but the degree can vary depending on the major sources of uncertainty for a particular site. The types of toxicity information uncertainties for this risk assessment are outlined below.

Uncertainties Inherent in the Risk Assessment Process

- Use of animal data to predict potential human health effects.

- Extrapolation of effects observed in animals exposed to high doses to probable outcomes in humans following exposure to low environmental contaminant levels.

- A conservative approach to calculate toxicological criteria such as the oral and dermal RfD and inhalation RfC with uncertainty spans of perhaps one order of magnitude. These estimates can change when additional information becomes available. The carcinogenic slope factors and unit risks are typically calculated by the USEPA using a linearized multistage model, which leads to a plausible upper-bound estimate of the risk, although the true value of the risk is unknown and may be as low as zero (USEPA, 1986).

Uncertainties Common to Current EPA Guidance on Risk Assessment

- Lack of pertinent toxicological data for the chemicals selected for the quantitative risk assessment. For this risk assessment, 3,4-dichloroaniline was retained as a COC. The risks calculated for this compound were derived using 4-chloroaniline toxicity values as surrogates. Currently, 3,4-dichloroaniline does not have published toxicity values and the information available describing its toxicity is limited. 4-Chloroaniline was used as a surrogate based on similarities in structure. Therefore, the risk presented for this compound is uncertain.

- Lack of specific toxicity criteria to evaluate of the dermal exposure route. The current USEPA default position is to adjust the oral toxicity value with an oral absorption factor and adopt this adjusted value as the surrogate dermal toxicity value. The validity and scientific basis for this extrapolation warrant further deliberation, because the mechanism for absorption through a skin barrier (i.e., the dermal route) is expected to be different than absorption through a gastrointestinal system (i.e., the oral route). However, the current method recommended by USEPA to extrapolate default dermal toxicity values does not reflect the specific conditions under which the reference toxicological study was conducted (e.g., method of administration such as gavage, water, or diet, and vehicle of administration such as solvent, oil, or solution).

2.5.6.4 Site-Specific Uncertainties

- Sites 1, 3, 5, 6, 8, and 9 are primarily open, grassy, pavement, or gravel areas to which controlled access. Therefore, surface soil exposures for the adult workers and trespassers would be minimized. For the adult worker the most likely exposure is for a maintenance worker, who is involved with seasonal activities such as mowing grass and other maintenance activities at each site. As such the maintenance worker would have a limited exposure frequency at each site. However, there is little default guidance for the maintenance worker scenario and site-specific information for the maintenance worker varies from site to site depending on surface cover , weather patterns during the year, and the activities involved. To eliminate the need for addressing each of these factors, a default site worker scenario was evaluated. Because the default site worker scenario is more conservative than a maintenance worker scenario would be, risk for these areas is overestimated.

- Perched groundwater exposure would most likely occur only if this water table were infiltrated during construction activities. Additionally, depending on the volume of water present, construction activities may cease until the water is removed. Risks associated with construction worker exposure to perched groundwater are highly conservative and are most likely overestimated.

- Access to CCC is controlled using fences, guards, and checkpoints. Trespassing onto the site is not likely; therefore, trespasser risk is most likely overestimated.

- Future land use for the site and the adjacent properties will most likely remain commercial/industrial or agricultural. If the site were to be used for future residential or agricultural purposes, it would need to be reevaluated for those land-use scenarios.

- The estimated VOC concentrations in air are applicable using the assumptions defined for the model used. However, given the variability in irrigation rates, the types of irrigation devices used, differences in irrigation methods, and changes in climate, the calculated VOC concentration in air could be an overestimate of the actual concentration.

- The mathematical model used to estimate VOC concentrations released from alluvial groundwater is based on a model that does not take into account any affects dispersion to the atmosphere might have on airborne VOC concentrations. This would indicate that the airborne VOC concentrations are most likely overestimated.

- Estimates VOC concentrations in air are based on concentrations of VOCs in alluvial groundwater samples collected onsite or a considerable distance upgradient of the closest irrigation well where VOC concentrations would be expected to be higher. No samples were collected from downgradient agricultural wells, resulting in a data gap. Because VOC concentrations in the agricultural wells are unknown, the actual risk associated with VOCs released from alluvial groundwater is uncertain. However, the risk estimates calculated using current onsite data most likely overestimate risk.

- COCs were selected if the carcinogenic risk was greater than 1E-06 and noncarcinogenic risk was greater than 1. A general concern for this process is that chemicals that do not meet the COC criteria still contribute to an unacceptable cumulative risk. For this HHRA, risk was estimated using highly conservative exposure parameters (as described in Section 2.5.6.2), toxicity values (as described in Section 2.5.6.3), and worst-case land use assumptions (as described in Section 2.5.6.4) resulting in risk that is inherently overestimated. Therefore, excluding chemicals that do not meet the COC criteria is not likely to underestimate risk.

2

3.0 ECOLOGICAL EVALUATION

The ERA is a key component of the baseline risk evaluation. Its purpose is to develop a qualitative and/or quantitative ecological appraisal of the actual and/or potential effects of CCC contamination on the surrounding ecosystem. The assessment considers environmental media and exposure pathways that could result in unacceptable levels of exposure to flora and fauna currently or in the foreseeable future. The approach to assessing risk components was based on *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (USEPA, 1997) and *Framework for Ecological Risk Assessment* (USEPA, 1992c).

3.1 Problem Formulation

Environmental Setting

For the ecological risk assessment only, three areas of concern were identified. Area I consists of three onsite ditches that make up the storm water retention system. Area II consists of an approximately 2-acre isolated wetland on the southwest boundary of the plant property. Area III includes all adjacent offsite nonindustrial areas. An ecological checklist conducted using guidance provided by USEPA (1997c) is presented in Appendix K.

Area I

Area I consists of three onsite ditches which serve as a storm water retention system. This retention system is a component of the waste water treatment system identified as Site 3 in Figure 5. Storm water collected in these ditches is used in the wastewater treatment system as required by the facility's National Pollution Discharge Elimination System (NPDES) permit. These open ditches are vegetated with various grasses along the edges and submergent plants are present in the more frequently inundated portions. During the June 4, 1999, ecological survey two species of tadpoles (Bullfrog, *[Rana catesbeiana]* and Southern leopard frog, *[Rana utricularia]*) were observed in the ditches. Two species of birds were also feeding in and around the ditches. The killdeer *(Charadrius vociferus)*, a farm country plover, usually inhabits fields, airports, lawns, river banks, shores and the green heron *(Butorides striatus)* feeds on fish, frogs, crawfish, insects, and other aquatic life.

Area II

Area II consists of an approximately 2-acre wetland constructed in 1978 to serve as an overflow retention pond for the waste water treatment system (Figure 3). After the pond was excavated, it was realized that an overflow system was not necessary; therefore, a connection between the treatment system and the ponds was never installed. Over the years, the excavated area developed wetland characteristics through natural secession and now meets the Corps of Engineers definition of a wetland. The dominant wetland vegetation consists of black willow *(Salix nigra)*, Chickasaw plum *(Prunus angustifolia)*, common cattails (*Typha latifolia*), floating primrose willow (*Ludwgia spp.*) and duckweed (*Lemna spp.*)

Area III

Area III includes offsite nonindustrial areas within one mile of the facility (see Figure 11). These areas include agriculture farm lands, ditches, and tributaries to Big Creek. The tributaries discharge into Big Creek is approximately 15 miles southeast of the facility.

Approximately 99% of Area III is cultivated with cotton and soybeans, in the fall/winter, most fields have a cover crop of winter wheat.

3.2 Threatened and Endangered Species

Based on information from the Arkansas Game & Fish Commission and the Arkansas Natural Heritage Commission, 16 state and federal listed threatened and endangered species are in Phillips County (Appendix H). None has been identified in or around the site because of the area's heavy industrialized/agricultural use. These findings were confirmed by the

Arkansas Natural Heritage Commission files and database search, which identified no occurrence of rare plants and animals, outstanding natural communities, natural or scenic rivers, or other elements of special concern within a 1-mile radius of the Cedar Chemical Company. A copy of this letter is presented in Appendix H .

3.3 Selection of Ecological Chemicals of Potential Concern

Ecological chemicals of potential concern (ECPC) from historic site activities have been identified and quantified using USEPA's methods and protocols for sediment analyses. For this assessment, only sediment samples were reviewed. No surface soil samples pertain to any of the three identified ecological areas. At Area I, only sediment samples were collected. At Area II, one geoprobe borehole was installed and both water and soil were collected. Area III sampling consisted of deep subsurface soil samples and groundwater. Because ecological risk is usually associated with only the top 6 inches of soil and no contaminant pathway exist for offsite surface soil, soil was not considered. Groundwater will be discussed later in this assessment, but no potential exposure pathway has ever been sampled. Because offsite agriculture wells may complete the pathway, they will be discussed. For the ERA, the USEPA's Region IV Supplemental Guidance to RAGS Bulletins and the Office of Solid Waste and Emergency Response (OSWER) sediment screening values were used to select potential ECPCs.

To identify chemicals that may pose a risk to the environment, the ERA used only the results from surficial sediment samples (0 to 6 inches bgs). It is presumed, even considering root development in the lower strata, that most biological effects are limited to this upper zone. In sediment, analytes were selected as an ECPC if the maximum concentration detected either: (1) exceeded the USEPA Region IV Sediment Screening Value and/or OSWER Values, (2) exceeded the most conservative effects level found in literature, or (3) if neither of these benchmarks were available.

3.4 Chemicals in Sediments

To present sediment conditions at Area I, the range of concentrations detected in sediments, the total number of samples analyzed (N), the number of detections, the minimum and maximum concentration for each parameter, the EPA Sediment Screening Value (SSV) and the ECPCs retained for consideration in the area-specific risk assessment are tabulated below.

3.5 Contaminants of Concern

To be conservative, ecological risk evaluations assume exposure to the maximum concentrations for each detected contaminant of concern.

In Area I, all chemicals were designated as ECPCs because maximum concentrations exceeded the sediment screening values.

In the Area II wetland, no sample data were collected because no exposure pathway was identified between the suspected source and the wetland was identified.

Area III sample data consist of subsurface soil and groundwater data only therefore, risk to terrestrial receptors could not be assessed. No ecological benchmarks exist for contaminated groundwater and ecological receptors are unlikely to be exposed to subsurface soil.

Cedar Chemical Corporation
Area I
Ditch Sediment Concentrations

					OSWER		
Parameter	**N**	**Detections**	**Range**	**SSV**	**Value**	**Type**	**ECPC**
METALS (ppm)							
Arsenic	12	1	20	7.24	8.2	ER-L	Yes

Cedar Chemical Corporation
Area I
Ditch Sediment Concentrations

Parameter	N	Detections	Range	SSV	OSWER Value	OSWER Type	ECPC
PESTICIDES (ppb)							
Aldrin	12	4	2.8-58	—	—	—	Yes
Dieldrin	12	4	5.6-550	3.3	52	SQC	Yes
4,4'-DDE	12	6	2-78	3.3	—	—	Yes
4,4'-DDD	12	9	7.6-180	3.3	—	—	Yes
4,4'-DDT	12	2	15-91	3.3	—	—	Yes
Endrin	12	2	76-89	3.3	20	SQC	Yes
gamma-BHC	12	1	18	3.3	3.7	SQB	Yes
Methoxychlor	12	6	130-2500	—	19	SQB	Yes
Toxaphene	12	1	1600	—	28	SQB	Yes

Notes:
N = Number of samples
SSV = USEPA Region IV Sediment Screening Value
ER-L = Effects Range-Low
SQC = Sediment Quality Criteria
SQB = Sediment Quality Benchmark

3.6 Characteristics of ECPCs

Inorganics

Arsenic was detected in one sample at 20 parts per million (ppm), which exceeds the SSV of 7.24 ppm. Soil biota appear to be capable of tolerating and metabolizing relatively high concentrations (microbiota to 1,600 ppm) of arsenic (Wang et al., 1984), but adverse effects to aquatic organisms have been reported at concentrations of 19 to 48 parts per billion (ppb) in water. Arsenic soil does not appear to magnify along the aquatic food chain.

Organics

Organochlorine pesticides have been used extensively in the United States since the 1940s and they appear to be ubiquitous in the environment, that is, they are present in surface water, sediment, and biological tissues. They are readily absorbed by warm-blooded species and degradatory products are frequently more toxic than the parent form. In soil invertebrates, organochlorine pesticides can accumulate to concentrations higher than those in the surrounding soil, and residues may be ingested by birds and other animals feeding on earthworms (Beyer and Gish, 1980). Most environmental effects studies have been directed at mammals and birds.

3.7 Exposure Pathways and Assessment

In Area I, all chemicals were selected as ECPCs because they either exceeded the sediment screening values or did not have a respective screening value. Two potential pathways were identified. Tadpoles in the ditches are exposed to contaminated sediments. The tadpoles could be bioaccumulating pesticides from exposure to contaminated sediments. Piscivorus birds could also ingest potentially contaminated tadpoles.

In Area II, no potential pathways were identified. The wetland was originally built as an overflow pond to collect overflows from adjacent waste treatment ponds; however, Cedar determined that the overflow pond was not needed and the connection between the overflow pond and the waste ponds was never constructed. Since the overflow pond was not needed Cedar did not maintain the levees or the pond itself. Over time the pond developed wetland characteristics due to lack of maintenance. The wetland is located across Industrial Park Road from the main Cedar plant and the only contamination in the proximity of the wetland is groundwater underlying the treatment pond which flows south, away from the wetland. There is no evidence that contamination has ever impacted the wetland, and furthermore there is no pathway associated with the site to the wetland.

In Area III, the potential pathway from crop irrigation using contaminated groundwater has been identified because irrigation wells have not been sampled, no data are available to assess risk.

3.8 Ecological Effects Assessment

A screening-level risk evaluation has been conducted for wildlife potentially living in the Area I ditches. Potential dietary exposure has not been calculated due to lack of amphibian toxicity information from literature searches. A comparison between the sediment concentrations and available SSVs determined potential for any adverse effects.

Although two potential pathways have been identified, in Area I, the predicted ecological risk is less significant because storm water retention ditches are a component of the waste water treatment system. Storm water collected in the ditches is held until it is needed to treat the facility's process water discharged into the waste water treatment system. During the summer months 35,000 to 40,000 gallons of water are pumped into the treatment system each day. During dry summer months, the reserve storm water is depleted very fast and the ditches remain dry most of the summer. In late spring and early summer, the ditches hold water for longer periods and are used by opportunistic species such as frogs and wading birds. The ditches are dry until the fall and no longer provide suitable habitat. This short-term exposure to opportunistic species presents only marginal risk exposure. Area I is also in the middle of a heavily industrialized area and its discharge was designed to meet NPDES requirements. All treated water from Area I ditches has passed the same biomonitoring test as the effluent discharge from the waste water treatment system. Appendix I contains copies of the most recent biomonitoring report from the effluent discharge and a sample taken from the treatment ponds themselves.

Area II has been excluded from a detailed evaluation because no complete pathway exist, based on site visits and historical data.

Area III has one potential pathway that consists of contaminated groundwater being introduced to the surface by agriculture irrigation wells. Although wildlife could be at risk from contaminated groundwater, it is highly unlikely.

First, the downgradient agriculture wells have never been sampled and exact chemical concentrations are unknown.

Second, only VOCs have been detected in the most downgradient monitoring well. If present in the agriculture wells, the contaminant of concern, 1,2-dichloroethane would most likely evaporate due to relatively high vapor pressure when released to the land. Releases to the atmosphere would degrade by reaction with hydroxyl radicals. Given the poor degradation characteristics of 1,2-dichloroethane, the primary attenuation mechanisms are evaporation and natural attenuation through advection, diffusion, and dispersion.

Third, no viable habitat is present in Area III. Only a few populations of small mammal and passerine birds species are present. During the hot summer months when irrigations is most frequent, wildlife species are dormant during the heat of the day and seek refuge in wooded areas. Significant wildlife exposure to contaminated groundwater during irrigation is not anticipated.

3

4.0 REMEDIAL GOAL OPTIONS

RGOs are site-specific chemical concentrations used by risk managers during the development of remedial alternatives. They are calculated to equate with specific target carcinogenic and noncarcinogenic risk levels. For this HHRA, RGOs were calculated for chemicals having an ILCR greater than 1E-6 or an HQ greater than 1. Those COCs which required calculation of RGOs are listed in Section 2.5.4. Inclusion in the RGO table does not necessarily indicate that remedial action will be required to address a specific chemical. Instead, RGOs are provided to facilitate risk-management decisions.

In accordance with USEPA Region IV Supplemental Guidance (USEPA, 1995a), RGOs were calculated at 1E-6, 1E-5, and 1E-4 risk levels for carcinogenic COCs and HQ levels of 0.1, 1, and 3 for noncarcinogenic COCs for all applicable media and receptors using the following equations:

$$RGO_{NCR} = \frac{EPC \times THQ}{Calculated\ HQ} \qquad \text{Equation 17}$$

$$RGO_{CR} = \frac{EPC \times TR}{Calculated\ CR} \qquad \text{Equation 18}$$

where:

RGO_{NCR}	=	noncarcinogenic remedial goal option (unitless)
EPC	=	exposure point concentration (mg/kg)
THQ	=	target hazard quotient (0.1, 1, 3) (unitless)
HQ	=	hazard quotient (unitless)
RGO_{CR}	=	carcinogenic remedial goal option (unitless)
TR	=	target carcinogenic risk (1E-06, 1E-05, 1E-04)
CR	=	cancer risk (unitless)

RGOs are presented for sediment, surface and subsurface soil, surface soil, perched groundwater, and alluvial groundwater in the following tables:

Table Number	Site	Media	Receptor
91	1	Sediment	Construction Worker Trespasser
92	2	Surface and Subsurface Soil	Construction Worker
93	3	Subsurface Soil	Construction Worker
94	3	Surface and Subsurface Soil	Construction Worker
95	9	Surface Soil	Adult Worker Trespasser
95	9	Surface and Subsurface Soil	Construction Worker
96	1 and 2	Perched Groundwater	Construction Worker
97	NA	Alluvial Groundwater	Offsite Agricultural Worker

4

5.0 CONCLUSIONS

Alluvial groundwater risks based on RME for the offsite agricultural worker are the only cancer risks that are above 1E-04 for this facility. However, these risks are most likely overestimated because the concentrations of VOCs in offsite alluvial groundwater (at the agricultural wells) are unknown, VOCs are highly volatile and are most likely lost to the atmosphere during irrigation, workers are either not present or present for limited time periods during irrigation, which indicates that the exposure frequency and duration is overestimated. Noncarcinogenic risks for the RME for all receptors are substantially high. The highest risks are to construction workers exposed to Dinoseb in surface and subsurface soil at Sites 3, 4, and 9.

For ecological receptors, potential risk in Area I is considered acceptable because these ditches are integral components of the facility's waste water treatment system. Because of the ditches function, standing water is frequently drained and any aquatic habitat is considered opportunistic. The isolated wetland in Area II is not considered at risk because the exposure pathway is incomplete. Risk to ecological receptors in Area III from exposure to contaminated groundwater resulting from farm irrigation is considered minimal based on the lack of receptors and the high volatility of 1,2-dichloroethane. No threatened and endangered species were present within a 1-mile radius of the site. This was confirmed by the Arkansas Natural Heritage Commission.

5

USEPA. (1991, March 25). *Human Health Evaluation Manual Supplemental Guidance. "Standard Default Exposure Factors."* Interim Final. OSWER Directive 9285.6-03.

USEPA. (1992a, September 23, 1992). *Human Health Evaluation Manual, Supplemental Guidance: "Interim Dermal Risk Assessment Guidance."*

USEPA. (1992b). *Supplemental Guidance to RAGS: Calculating the Concentration Term.* OSWER. Washington, DC. (9285.7-081).

USEPA. (1992c, February). *Framework for Ecological Risk Assessment.* Risk Assessment Forum, Washington, DC. EPA/630/R-92/001.

USEPA. (1994, November 22). *Amended Guidance on Preliminary Risk Evaluations (PREs) for the Purpose of Reaching a Finding of Suitability to Lease.*

USEPA. (1995a). *EPA Region IV: Supplemental Guidance to RAGS: Bulletins 1-4.* Office of Health Assessment — Waste Management Division: Atlanta, GA.

USEPA. (1995b). *Screening Method for Estimating Inhalation Exposure to Volatile Chemicals from Domestic Water.* Exposure Assessment Group — Office of Health Effects Assessment: Washington, DC.

USEPA. (1995c). *Supplemental Guidance to RAGS: Region IV Bulletins, Ecological Risk Assessment* — Draft. Waste Management Division, Office of Health Assessment, November.

USEPA. (1996, April). *Soil Screening Guidance: User's Guide*. OSWER: Washington, DC. (PB96-963505).

USEPA. (1997a, August). Exposure Factor Handbook. Office of Emergency and Remedial Response. Washington, DC. EPA/600/P-95/002A.

USEPA. (1997b). *Health Effects Assessment Summary Tables, Annual 1995 with* Supplement. Office of Emergency and Remedial Response, Washington, DC (PB95-921199).

USEPA. (1997c). *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments*. USEPA, Envir. Response Team: Edison, NJ.

USEPA. (1998a). *Risk Assessment Guidance for Superfund: Volume I, Human Health Evaluation Manual (Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments)*. Interim. Office of Emergency and Remedial Response: Washington, DC (PB9285.7-01D).

USEPA. (1998b, October). Region VI Human Health Medium-Specific Screening Levels. USEPA Region VI: Dallas, TX.

USEPA. (1998c). *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*.

Wang, D.S., R.W. Weaver, and J.R. Melton. (1984). *Microbial Decomposition of Plant Tissue Contaminate with Arsenic and Mercury*. Environmental Pollution 34A:275-282.

6

Appendix A

Risk Assessment Tables

TABLE 1

SUMMARY OF MAXIMUM CONTAMINANT LEVELS AND TAPWATER MEDIUM-SPECIFIC SCREENING LEVELS

CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

	Chemical	MCL (µg/L)	Tap Water MSSL (µg/L)	Industrial Drinking Water RBC (µg/L)	Toxicity Basis	Cedar Residential Screening Value[a] (µg/L)	Cedar Industrial Screening Value[a]	Basis
Inorganics								
	Arsenic	100	0.045	0.09	C	0.045	0.09	MSSL
	Barium	2000	2555	5110	N	2000	2000	MCL
	Cadmium	5	18.3	36.5	N	5	5	MCL
	Chromium	100	183	365	N	100	100	MCL
	Iron	NA	10950	21900	N	10950	21900	MSSL
	Lead	15	15	30	NA	15	15	TTAL
	Mercury	2	10.95	21.9	N	2	2	MCL
	Selenium	50	183	365	N	50	50	MCL
	Silver	NA	183	365	N	183	365	MSSL
Pesticides								
	4,4'-DDT	NA	18.25	36.50	C	18.25	36.50	MSSL
	Endosulfan	NA	219	438	N	219	438	MSSL
	HCH (alpha)	NA	0.011	0.021	C	0.011	0.021	MSSL
	Methoxychlor	40	183	365	N	40	40	MCL
	Propanil	NA	183	365	N	183	365	MSSL
Semivolatile Organic Compounds								
	1,2,4-Trichlorobenzene	70	194	389	N	70	70	MCL
	2-Chloronaphthalene	NA	487	973	N	487	973	MSSL
	2-Methylnaphthalene	NA	6	12	N	6	12	MSSL
	2-Methylphenol (o-Cresol)	NA	1825	3650	N	1825	3650	MSSL
	3,4-Dichloroaniline	NA	146	292	N	146	292	MSSL
	4-Chloroaniline	NA	146	292	N	146	292	MSSL
	4-Nitrophenol	NA	2263	4526	N	2263	4526	MSSL
	Dimethylphthalate	NA	365000	730000	N	365000	730000	MSSL
	Di-n-butylphthalate	NA	3650	7300	N	3650	7300	MSSL
	Dinoseb	7	36.5	73	N	7	7	MCL
	Isophorone	NA	70.8	142	C	71	142	MSSL
	Naphthalene	NA	6	12	N	6	12	MSSL
	Phenol	NA	21900	43800	N	21900	43800	MSSL
	Propanil	NA	183	365	N	183	365	MSSL
	Pyrene	NA	183	365	N	183	365	MSSL
	bis(2-Ethylhexyl)phthalate	6	4.8	9.6	C	4.8	6	MSSL
Volatile Organic Compounds								
	1,1,2-Trichloroethane	5	0.2	0.8	C	0.2	0.8	MSSL
	1,1-Dichloroethene	7	0.046	0.18	C	0.046	0.18	MSSL
	1,2-Dichlorobenzene	NA	370	1481	N	370	1481	MSSL
	1,2-Dichloroethane	5	0.12	0.49	C	0.12	0.49	MSSL
	trans-1,2-Dichloroethene	100	122	487	C	100	100	MCL
	1,2-Dichloropropane	5	0.16	0.66	C	0.16	0.66	MSSL
	1,3-Dichlorobenzene	600	16.5	66.1	N	16.5	66.1	MSSL
	1,4-Dichlorobenzene	75	0.467	1.9	C	0.467	1.9	MSSL
	2-Butanone	NA	1904	7617	N	1904	7617	MSSL
	2,6-Dinitrotoluene	NA	36.5	146	N	36.5	146	MSSL
	4-Methyl-2-Pentanone (MIBK)	NA	158	631	N	158	631	MSSL
	Acetone	NA	608	2433	N	608	2433	MSSL
	Benzene	5	0.42	1.7	C	0.42	1.7	MSSL
	Bromodichloromethane	NA	0.18	0.72	C	0.18	0.72	MSSL
	Bromoform	100	9	34	C	9	34	MSSL
	Carbon disulfide	NA	1043	4171	N	1043	4171	MSSL
	Carbon tetrachloride	5	0.17	0.69	C	0.17	0.69	MSSL

TABLE 1

SUMMARY OF MAXIMUM CONTAMINANT LEVELS AND TAPWATER MEDIUM-SPECIFIC SCREENING LEVELS

CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

	Chemical	MCL (µg/L)	Tap Water MSSL (µg/L)	Industrial Drinking Water RBC (µg/L)	Toxicity Basis	Cedar Residential Screening Value[a] (µg/L)	Cedar Industrial Screening Value[a]	Basis
	Chlorobenzene	NA	39.5	158	N	39.5	158	MSSL
	Chloroethane	NA	8588	34353	N	8588	34353	MSSL
	Chloroform	NA	0.16	0.66	C	0.16	0.66	MSSL
Volatile Organic Compounds								
	Dibromochloromethane	NA	0.13	0.53	C	0.13	0.53	MSSL
	Ethylbenzene	700	1340	5359	N	700	700	MCL
	Methylene chloride	NA	4.3	17.1	C	4.3	17.1	MSSL
	Toluene	1000	723	2894	N	723	1000	MSSL
	Trichloroethene	5	1.6	6.6	C	1.6	5	MSSL
	Vinyl acetate	NA	412	1650	N	412	1650	MSSL
	bis(2-Chloroethyl)ether	NA	0.0098	0.039	C	0.0098	0.039	MSSL
	m-Xylene	NA	1431	5725	N	1431	5725	MSSL
	o-Xylene	NA	1431	5725	N	1431	5725	MSSL

Notes:

MCL = maximum contaminant level

MSSL = Region 6 Medium-specific Screening Level

RBC = risk-based concentration

µg/L = micrograms per liter

N = noncarcinogen

C = carcinogen

NA = not applicable

TTAL = Value is the treatment technique action level presented in the Drinking Water Standards (USEPA, 1996).

(a) = The Cedar screening value is the more stringent value of the MCL and MSSL.

(b) = Industrial screening values are calculated using guidance provided by USEPA (1994).

where: VOC_{ind} = Tap Water MSSL × 0.25

$NON\text{-}VOC_{ind}$ = Tap Water MSSL × 0.5

TABLE 2
SITE-SPECIFIC SOIL SCREENING LEVELS – SOIL-WATER PARTITION EQUATION MODEL
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

	EQUATION	SSL	=	C_w	× { (	K_d	+ [	θ_w	+ (	θ_a	×	H'	) +	ρ_b	] }
	UNITS	mg/kg		mg/L		L/kg		unitless		unitless		unitless		kg/L	
Inorganics	Arsenic	1.53E+03	=	5.25E+01	× { (	29	+ [	0.3	+ (	0.13	×	0	) +	1.5	] }
	Barium	8.65E+04	=	2.10E+03	× { (	41	+ [	0.3	+ (	0.13	×	0	) +	1.5	] }
	Cadmium	3.95E+02	=	5.25E+00	× { (	75	+ [	0.3	+ (	0.13	×	0	) +	1.5	] }
	Chromium	2.02E+03	=	1.05E+02	× { (	19 Cr^{+6}	+ [	0.3	+ (	0.13	×	0	) +	1.5	] }
	Lead	1.89E+01	=	1.58E+01	× { (	1	+ [	0.3	+ (	0.13	×	0	) +	1.5	] }
	Mercury	1.10E+02	=	2.10E+00	× { (	52	+ [	0.3	+ (	0.13	×	0	) +	1.5	] }
	Selenium	2.73E+02	=	5.25E+01	× { (	5	+ [	0.3	+ (	0.13	×	0	) +	1.5	] }
	Silver	1.63E+03	=	1.92E+02	× { (	8.3	+ [	0.3	+ (	0.13	×	0	) +	1.5	] }

	EQUATION	SSL	=	C_w	× { (	K_{oc}*	×	f_{oc}	) + [	θ_w	+ (	θ_a	×	H'	) +	ρ_b	] }
	UNITS	mg/kg		mg/L		L/kg		kg/kg		unitless		unitless		unitless		kg/L	
Organics	4,4'-DDD	2.70E+01	=	2.94E-01	× { (	45800	×	0.002	) + [	0.3	+ (	0.13	×	0.000166	) +	1.5	] }
	4,4'-DDE	3.59E+01	=	2.08E-01	× { (	86405	×	0.002	) + [	0.3	+ (	0.13	×	0.000873	) +	1.5	] }
	4,4'-DDT	3.29E+02	=	2.08E-01	× { (	792158	×	0.002	) + [	0.3	+ (	0.13	×	0.00223	) +	1.5	] }
	Aldrin	4.05E-01	=	4.15E-03	× { (	48686	×	0.002	) + [	0.3	+ (	0.13	×	0.00707	) +	1.5	] }
	alpha-BHC	4.34E-02	=	1.12E-02	× { (	1835	×	0.002	) + [	0.3	+ (	0.13	×	0.000282	) +	1.5	] }
	beta-BHC	1.84E-01	=	3.92E-02	× { (	2241	×	0.002	) + [	0.3	+ (	0.13	×	0.0000144	) +	1.5	] }
	delta-BHC[HSDB]	1.18E+00	=	2.10E-01	× { (	2700	×	0.002	) + [	0.3	+ (	0.13	×	0.00001763	) +	1.5	] }
	Dieldrin	2.27E-01	=	4.41E-03	× { (	25604	×	0.002	) + [	0.3	+ (	0.13	×	0.000111	) +	1.5	] }
	Endosulfan I	9.84E+02	=	2.30E+02	× { (	2040	×	0.002	) + [	0.3	+ (	0.13	×	0.000466	) +	1.5	] }
	EndosulfanII	9.84E+02	=	2.30E+02	× { (	2040	×	0.002	) + [	0.3	+ (	0.13	×	0.000466	) +	1.5	] }
	Endosulfan sulfate	9.84E+02	=	2.30E+02	× { (	2040	×	0.002	) + [	0.3	+ (	0.13	×	0.000466	) +	1.5	] }
	Endrin	4.84E+01	=	2.10E+00	× { (	11422	×	0.002	) + [	0.3	+ (	0.13	×	0.0000495	) +	1.5	] }
	Endrin ketone	4.84E+01	=	2.10E+00	× { (	11422	×	0.002	) + [	0.3	+ (	0.13	×	0.0000495	) +	1.5	] }
	gamma-BHC	6.62E-01	=	2.10E-01	× { (	1477	×	0.002	) + [	0.3	+ (	0.13	×	0.000141	) +	1.5	] }
	gamma-Chlordane	2.18E+02	=	2.10E+00	× { (	51798	×	0.002	) + [	0.3	+ (	0.13	×	0.00202	) +	1.5	] }
	Heptachlor	2.14E+00	=	1.05E-01	× { (	10070	×	0.002	) + [	0.3	+ (	0.13	×	0.0244	) +	1.5	] }
	Methoxychlor	6.73E+03	=	4.20E+01	× { (	80000	×	0.002	) + [	0.3	+ (	0.13	×	0.000657	) +	1.5	] }
	Propanil	1.23E+02	=	1.92E+02	× { (	220	×	0.002	) + [	0.3	+ (	0.13	×	1.85E-07	) +	1.5	] }
	1,2,4-Trichlorobenzene	2.59E+02	=	7.35E+01	× { (	1659	×	0.002	) + [	0.3	+ (	0.13	×	0.05822	) +	1.5	] }
	1,4-Dichlorobenzene	1.13E+02	=	7.88E+01	× { (	616	×	0.002	) + [	0.3	+ (	0.13	×	0.09963	) +	1.5	] }
	2-Chloronaphthalene	1.69E+03	=	5.11E+02	× { (	1550	×	0.002	) + [	0.3	+ (	0.13	×	0.0127	) +	1.5	] }
	2-Methylphenol (o-Cresol)	7.58E+02	=	1.92E+03	× { (	98	×	0.002	) + [	0.3	+ (	0.13	×	0.0000665	) +	1.5	] }
	2-Nitrophenol	2.16E+03	=	2.38E+03	× { (	355	×	0.002	) + [	0.3	+ (	0.13	×	0.0000146	) +	1.5	] }
	2,4-Dinitrophenol[HSDB]	4.60E+01	=	7.67E+01	× { (	200	×	0.002	) + [	0.3	+ (	0.13	×	3.53E-06	) +	1.5	] }
	3,4-Dichloroaniline[SRC,HSDB]	9.05E+01	=	1.53E+02	× { (	195	×	0.002	) + [	0.3	+ (	0.13	×	9.27E-04	) +	1.5	] }
	4,6-Dinitro-2-methylphenol	1.06E+02	=	7.67E+01	× { (	590	×	0.002	) + [	0.3	+ (	0.13	×	1.75E-05	) +	1.5	] }
	4-Chloroaniline[SRC]	1.74E+02	=	1.53E+02	× { (	469	×	0.002	) + [	0.3	+ (	0.13	×	0.0004756	) +	1.5	] }
	4-Nitrophenol	2.55E+03	=	2.38E+03	× { (	437	×	0.002	) + [	0.3	+ (	0.13	×	7.32E-09	) +	1.5	] }
	Benzoic acid	4.05E+04	=	1.53E+05	× { (	32	×	0.002	) + [	0.3	+ (	0.13	×	0.0000139	) +	1.5	] }
	bis(2-Ethylhexyl)phthalate	1.44E+03	=	6.30E+00	× { (	114337	×	0.002	) + [	0.3	+ (	0.13	×	0.000457	) +	1.5	] }
	Dimethylphthalate	8.65E+03	=	3.07E+04	× { (	41	×	0.002	) + [	0.3	+ (	0.13	×	0.000024	) +	1.5	] }
	Di-n-butylphthalate	1.29E+04	=	3.83E+03	× { (	1580	×	0.002	) + [	0.3	+ (	0.13	×	0.0000594	) +	1.5	] }
	Di-n-octylphthalate	9.35E+05	=	7.67E+02	× { (	610000	×	0.002	) + [	0.3	+ (	0.13	×	1.85E-05	) +	1.5	] }
	Dinoseb[TNRCC]	1.92E+01	=	7.35E+00	× { (	1202	×	0.002	) + [	0.3	+ (	0.13	×	0.0208	) +	1.5	] }
	Fluoranthene	1.52E+05	=	1.53E+03	× { (	49433	×	0.002	) + [	0.3	+ (	0.13	×	0.000388	) +	1.5	] }
	Isophorone	1.94E+01	=	7.43E+01	× { (	30	×	0.002	) + [	0.3	+ (	0.13	×	0.000257	) +	1.5	] }
	Phenol	5.40E+03	=	2.30E+04	× { (	17	×	0.002	) + [	0.3	+ (	0.13	×	0.0000247	) +	1.5	] }
	Pyrene	2.72E+04	=	1.92E+02	× { (	70808	×	0.002	) + [	0.3	+ (	0.13	×	0.000457	) +	1.5	] }
	1,1-Dichloroethene	3.11E+00	=	7.35E+00	× { (	65	×	0.002	) + [	0.3	+ (	0.13	×	1.0701	) +	1.5	] }
	1,2-Dichlorobenzene	3.75E+02	=	3.89E+02	× { (	379	×	0.002	) + [	0.3	+ (	0.13	×	0.0779	) +	1.5	] }
	1,2-Dichloroethane	1.47E+00	=	5.25E+00	× { (	38	×	0.002	) + [	0.3	+ (	0.13	×	0.040139	) +	1.5	] }
	1,2-Dichloropropane	1.60E+00	=	5.25E+00	× { (	47	×	0.002	) + [	0.3	+ (	0.13	×	0.1148	) +	1.5	] }
	4-Methyl-2-Pentanone (MIBK)	7.76E+01	=	1.66E+02	× { (	134	×	0.002	) + [	0.3	+ (	0.13	×	0.00574	) +	1.5	] }
	Acetone	1.29E+02	=	6.39E+02	× { (	0.575	×	0.002	) + [	0.3	+ (	0.13	×	0.0015908	) +	1.5	] }
	Benzene	1.80E+00	=	5.25E+00	× { (	62	×	0.002	) + [	0.3	+ (	0.13	×	0.22755	) +	1.5	] }
	bis(2-Chloroethyl)ether	3.62E-03	=	1.03E-02	× { (	76	×	0.002	) + [	0.3	+ (	0.13	×	0.000738	) +	1.5	] }
	Carbon disulfide	4.37E+02	=	1.09E+03	× { (	45.7	×	0.002	) + [	0.3	+ (	0.13	×	1.2423	) +	1.5	] }
	Carbon tetrachloride	3.21E+00	=	5.25E+00	× { (	152	×	0.002	) + [	0.3	+ (	0.13	×	1.2464	) +	1.5	] }
	Chlorobenzene	2.74E+01	=	4.14E+01	× { (	224	×	0.002	) + [	0.3	+ (	0.13	×	0.1517	) +	1.5	] }
	Chloroform	5.51E-02	=	1.73E-01	× { (	53	×	0.002	) + [	0.3	+ (	0.13	×	0.15047	) +	1.5	] }
	Ethylbenzene	4.67E+02	=	7.35E+02	× { (	204	×	0.002	) + [	0.3	+ (	0.13	×	0.32308	) +	1.5	] }
	Methyl ethyl ketone (2-Butanone)	4.18E+02	=	2.00E+03	× { (	4.5	×	0.002	) + [	0.3	+ (	0.13	×	0.0011234	) +	1.5	] }
	Methylene chloride	1.02E+00	=	4.49E+00	× { (	10	×	0.002	) + [	0.3	+ (	0.13	×	0.08979	) +	1.5	] }
	Tetrachloroethene	4.18E+00	=	5.25E+00	× { (	265	×	0.002	) + [	0.3	+ (	0.13	×	0.7544	) +	1.5	] }

TABLE 2
SITE-SPECIFIC SOIL SCREENING LEVELS – SOIL-WATER PARTITION EQUATION MODEL
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

EQUATION	SSL	=	C_w	× { (	K_d			+ [	θ_w	+ (	θ_a	×	H'	) +	ρ_b	] }
UNITS	mg/kg		mg/L		L/kg				unitless		unitless		unitless		kg/L	
Toluene	$\boxed{5.29E+02}$	=	1.05E+03	× { (	140	×	0.002	) + [	0.3	+ (	0.13	×	0.27224	) +	1.5	] }
Trichloroethene	$\boxed{2.23E+00}$	=	5.25E+00	× { (	94.3	×	0.002	) + [	0.3	+ (	0.13	×	0.4223	) +	1.5	] }
Xylene (total)	$\boxed{1.05E+03}$	=	1.50E+03	× { (	241	×	0.002	) + [	0.3	+ (	0.13	×	0.21279	) +	1.5	] }

Notes:

SSL = soil screening level based on mass-limit equation
C_w = target soil leachate concentration (Region 6 Medium Specific Screening Level for tap-water or if available maximum contaminant level) adjusted using a DAF of 20
K_d = soil-water partition coefficient for inorganics at pH 6.8 from the Soil Screening Guidance Technical Background Document (USEPA, 1996).
θ_w = water-filled soil porosity (default value)
θ_a = air-filled soil porosity (default value)
H' = Henry's law constant (dimensionless)
ρ_b = dry soil bulk density (default value)
K_{oc} = soil organic carbon-water partition coefficient
f_{oc} = fraction of organic carbon in soil (g carbon/g soil) default OK
mg/k = milligrams per kilogram
mg/L = milligrams per liter
L/kg = liter per kilogram

SRC = Henry's law constant or K_{oc} taken from the Syracuse Research Corporation Environmental Fate Database at http://esc-plaza.syrres.com/efdb.htm.
HSD = Henry's law constant or K_{oc} taken from the Hazardous Substance Data Bank at http://toxnet.nlm.nih.gov/.

TABLE 3
BACKGROUND CONCENTRATION CALCULATION FOR INORGANIC COMPOUNDS
DETECTED IN SURFACE SOIL
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

	Concentration			
Sample Location	Arsenic	Barium	Chromium	Lead
BGHA-1	***3.9***	***204***	***13.1***	***10.1***
BGHA-2	***6.2***	***174***	***ND***	***10.3***
BGHA-3	***5.3***	***138***	***10.7***	***11.2***
CEDSBKG501	9.5	NS	NS	NS
CEDSBKG601	9.8	NS	NS	NS
CEDSBKG901	7.9	NS	NS	NS
CEDSBK1001	7.95	NS	NS	NS
Mean	7.2	172	11.9	10.5
Standard Deviation (SD)	2.183242455	33.04542328	1.697056275	0.5859465
Background Concentration[a]	**11.6**	**238**	**15.3**	**11.7**

All units are milligrams per kilogram (mg/kg)

ND = Not detected

NS = Not sampled

a = The background concentrations were calculated as the mean + 2 SD.

TABLE 4
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point	Site 1 Surface Soil

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background (2) Value	Screening (3) Toxicity Value	COPC Flag	Rationale for (4) Contaminant Deletion or Selection
7440382	**Arsenic**	**3.2**		**44.6**		**mg/kg**	**001SHA0201**	**10/12**	**5**	**44.6**	**11.6**	**0.38 C**	**YES**	**ASL**
72548	4,4'-DDD	12		110		ug/kg	001SHA0101	5/13	7-420	110	N/A	2356 C	NO	BSL
72559	4,4'-DDE	3.8		98		ug/kg	001SHA0101	9/13	2.7-150	98	N/A	1663 C	NO	BSL
50293	4,4'-DDT	9.7		380		ug/kg	001SHA0101	3/13	8-460	380	N/A	1663 C	NO	BSL
309002	Aldrin	22		22		ug/kg	001SHA0201	1/13	2.7-150	22	N/A	26.1 C	NO	BSL
319857	Beta-BHC	47		510		ug/kg	001SHA0501	2/13	4-24	510	N/A	315 C	YES	ASL
60571	**Dieldrin**	**593**		**593**		**ug/kg**	**001SHA0501**	**1/13**	**1.3-15**	**593**	**N/A**	**27.8 C**	**YES**	**ASL**
106467	1,4-Dichlorobenzene	260		260		ug/kg	001SHA0501	1/13	660-150000	260	N/A	3037 C	NO	BSL
84742	Di-n-butylphthalate	750		750		ug/kg	001SHA0501	1/13	660-150000	750	N/A	606294 N	NO	BSL
88857	Dinoseb	9600		9600		ug/kg	001SHA0101	1/13	462-150000	9600	N/A	6063 N	YES	ASL
129000	Pyrene	160		160		ug/kg	001SHA0201	1/13	660-150000	160	N/A	168406 N	NO	BSL
107062	**1,2-Dichloroethane**	**16**		**7500**		**ug/kg**	**001SHA0501**	**2/12**	**5-6**	**7500**	**N/A**	**339 C**	**YES**	**ASL**
78933	2-Butanone (MEK)	53		57		ug/kg	001SHA0401	2/12	11-100	57	N/A	702007 N	NO	BSL
108101	4-Methyl-2-Pentanone (MIBK)	92		92		ug/kg	001SHA0501	1/12	50-65	92	N/A	76023 N	NO	BSL
67641	Acetone	64		190		ug/kg	001SGB0101	3/12	11-100	190	N/A	148568 N	NO	BSL
67663	Chloroform	98		98		ug/kg	001SHA0501	1/12	5-6	98	N/A	245 C	NO	BSL
100414	Ethylbenzene	13		13		ug/kg	001SHA0501	1/12	5-6	13	N/A	233948 sat	NO	BSL
75092	Methylene chloride	6		6		ug/kg	001SHA0501	1/12	5-20	6	N/A	8506 C	NO	BSL
127184	Tetrachloroethene	760		760		ug/kg	001SHA0501	1/12	5-6	760	N/A	4727 C	NO	BSL
108883	Toluene	2		930		ug/kg	001SHA0501	3/12	5-6	930	N/A	521170 sat	NO	BSL

(1) Minimum/maximum detected concentration.

(2) Background concentration calculated using the arithmetic mean plus two standard deviations.

(3) Residential soil screening values are from USEPA Region 6 Human Health Medium-Specific Screening Levels (USEPA, 1999).

(4) Rationale Codes Selection Reason: Above Screening Levels (ASL)

Deletion Reason: Below Screening Level (BSL)

Definitions:
N/A = Not Applicable
COPC = Chemical of Potential Concern
C = Carcinogenic
N = Non-Carcinogenic
mg/kg = milligrams per kilogram
ug/kg = micrograms per kilogram
sat = Screening level is based on the soil saturation equation (USEPA, 1999).

TABLE 5
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe	Current Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 2 Surface Soil

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value (2)	Screening Toxicity Value (3)		COPC Flag	Rationale for Contaminant Deletion or Selection (4)
7440393	Barium	89.4		89.4		mg/kg	002SHA0501	1/1	N/A	89.4	238.0	5375	N	NO	BSL
7440439	**Cadmium**	**161.8**		**161.8**		**mg/kg**	**002SHA0501**	**1/1**	**N/A**	**161.8**	**N/A**	**39**	**N**	**YES**	**ASL**
7440473	Chromium	95.3		95.3		mg/kg	002SHA0501	1/1	N/A	95.3	15.3	211	N	NO	BSL
7439921	Lead	65.9		65.9		mg/kg	002SHA0501	1/1	N/A	65.9	11.7	400	N	NO	BSL
7439976	**Mercury**	**111.7**		**111.7**		**mg/kg**	**002SHA0501**	**1/1**	**N/A**	**111.7**	**N/A**	**23**	**N**	**YES**	**ASL**
7782492	Selenium	70.9		70.9		mg/kg	002SHA0501	1/1	N/A	70.9	N/A	391	N	NO	BSL
7440224	Silver	89.9		89.9		mg/kg	002SHA0501	1/1	N/A	89.9	N/A	391	N	NO	BSL
72548	4,4'-DDD	15		15		ug/kg	002S001501	1/4	7	15	N/A	2431	C	NO	BSL
72559	4,4'-DDE	11		11		ug/kg	002S001501	1/4	2.7	11	N/A	1716	C	NO	BSL
50293	4,4'-DDT	20		190		ug/kg	002S000501	1/4	8	190	N/A	1716	C	NO	BSL
309002	**Aldrin**	**11**		**58**		**ug/kg**	**002S000501**	**2/5**	**2.7**	**58**	**N/A**	**28**	**C**	**YES**	**ASL**
72208	Endrin	7		7		ug/kg	002S001501	2/5	4	7	N/A	18189	N	NO	BSL
72435	Methoxychlor	55		15000		ug/kg	002S000501	5/5	N/A	15000	N/A	303147	N	NO	BSL
88857	**Dinoseb**	**100000**		**100000**		**ug/kg**	**002S000501**	**1/4**	**462**	**100000**	**N/A**	**60629**	**N**	**YES**	**ASL**
67641	Acetone	200		1900		ug/kg	002S001001	2/4	100	1900	N/A	1485678	N	NO	BSL

(1) Minimum/maximum detected concentration.

(2) Background concentration calculated using the arithmetic mean plus two standard deviations.

(3) Residential soil screening values are from USEPA Region 6 Human Health Medium-Specific Screening Levels (USEPA, 1999).

(4) Rationale Codes Selection Reason: Above Screening Levels (ASL)

Deletion Reason: Below Screening Level (BSL)
Background Levels (BKG)

Definitions:
N/A = Not Applicable
COPC = Chemical of Potential Concern
mg/kg = milligrams per kilogram
ug/kg = micrograms per kilogram

TABLE 6
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Current Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 4 Surface Soil

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value (2)	Screening Toxicity Value (3)		COPC Flag	Rationale for Contaminant Deletion or Selection (4)
7440382	Arsenic	3.4		7		mg/kg	004SHA0801	9/9	N/A	7	11.6	0.39	C	NO	BKG
7440393	Barium	52.6		113		mg/kg	004SHA0801	9/9	N/A	113	238	5375	N	NO	BSL
7440439	Cadmium	0.37		0.44		mg/kg	004SHA0401	3/9	0.32-0.37	0.44	N/A	39	N	NO	BSL
7440473	Chromium	10.2		19.1		mg/kg	004SHA0501	9/9	N/A	19.1	15.3	30	C	NO	BSL
7439921	Lead	3.9		13		mg/kg	004SHA0501	9/9	N/A	13	11.7	400		NO	BSL
72548	4,4'-DDD	26		350		ug/kg	004S000201	4/14	7-82	350	N/A	2431	C	NO	BSL
72559	4,4'-DDE	5.2		250		ug/kg	004S000201	9/14	2.7-27	250	N/A	1716	C	NO	BSL
50293	4,4'-DDT	49.5		260		ug/kg	004SHA0201	4/14	8-80	260	N/A	1716	C	NO	BSL
319846	Alpha-BHC	14		14		ug/kg	004SHA0601	1/14	2-22	14	N/A	90	C	NO	BSL
60571	**Dieldrin**	**1.6**		**455**		**ug/kg**	**004S000401**	**3/14**	**1.3-15**	**455**	**N/A**	**30**	**C**	**YES**	**ASL**
959988	Endosulfan I	32		32		ug/kg	004SHA0601	1/14	9.4-100	32	N/A	363777	N	NO	BSL
33213659	Endosulfan II	3.4		3.4		ug/kg	004SHA0401	1/14	2.7-30	3.4	N/A	363777	N	NO	BSL
76448	Heptachlor	12		12		ug/kg	004SHA0501	1/14	2-22	12	N/A	107	C	NO	BSL
72435	Methoxychlor	120		15000		ug/kg	004SHA0203	10/14	130-150	15000	N/A	303147	N	NO	BSL
95501	1,2-Dichlorobenzene	120		3700		ug/kg	004SHA0601	3/14	660-37000	3700	N/A	372612	sat	NO	IFD
95761	3,4-Dichloroaniline	85000		85000		ug/kg	004SHA0501	1/9	390-37000	85000	N/A	242518	N	NO	IFD
106478	4-Chloroaniline	8600		8600		ug/kg	004SHA0501	1/14	700-72000	8600	N/A	242518	N	NO	IFD
84742	Di-n-butylphthalate	400		540		ug/kg	004SHA0501	2/14	660-37000	540	N/A	6062944	N	NO	BSL
131113	Dimethylphthalate	94		180		ug/kg	004SHA0701	2/14	660-37000	180	N/A	100000	max	NO	BSL
88857	**Dinoseb**	**1400**		**840000**		**ug/kg**	**004SHA0701**	**9/14**	**462-2310**	**840000**	**N/A**	**80829**	**N**	**YES**	**ASL**
709988	Propanil	690		2500		ug/kg	004SHA0601	2/9	690-37000	2500	N/A	303147	N	NO	BSL
117817	bis(2-Ethylhexyl)phthalate (BEHP)	1200		1200		ug/kg	004SHA0501	1/14	660-37000	1200	N/A	34530	C	NO	IFD
107062	1,2-Dichloroethane	9.9		9.9		ug/kg	004S000101	1/12	5-10	9.9	N/A	341	C	NO	BSL
78933	2-Butanone (MEK)	9		130		ug/kg	004S000101	5/12	11-100	130	N/A	7020072	N	NO	BSL
108101	4-Methyl-2-Pentanone (MIBK)	19		19		ug/kg	004SHA0501	1/12	50-64	19	N/A	760225	N	NO	BSL
67641	Acetone	19		250		ug/kg	004S000101	5/12	11-100	250	N/A	1485678	N	NO	BSL
108907	Chlorobenzene	3		3		ug/kg	004SHA0602	1/12	5-6	3	N/A	54202	N	NO	BSL
100414	Ethylbenzene	4		13		ug/kg	004S000101	3/12	5-6	13	N/A	233948	sat	NO	BSL
108883	Toluene	2		350		ug/kg	004SHA0501	6/12	5-6	350	N/A	521170	sat	NO	BSL
1330207	Xylene (total)	34.5		76		ug/kg	004SHA0501	4/12	5-13	76	N/A	214480	sat	NO	BSL

(1) Minimum/maximum detected concentration.
(2) Background concentration calculated using the arithmetic mean plus two standard deviations.
(3) Residential soil screening values are from USEPA Region 6 Human Health Medium-Specific Screening Levels (USEPA, 1999).
The following surrogate screening values were used:
-Endosulfan was used for Endosulfan I and Endosulfan II
-4-Chloroaniline was used for 3,4- dichloroaniline
(4) Rationale Codes
Selection Reason: Above Screening Levels (ASL)
Infrequent Detection (IFD)
Deletion Reason: Background Levels (BKG)
Below Screening Level (BSL)

Definitions:
N/A = Not Applicable
COPC = Chemical of Potential Concern
C = Carcinogenic
N = Non-Carcinogenic
mg/kg = milligrams per kilogram
sat = Screening level is based on the soil saturation equation (USEPA, 1999)
max = non-risk based ceiling limit

TABLE 7

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Current Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 6 Surface Soil

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background (2) Value	Screening (3) Toxicity Value		COPC Flag	Rationale for (4) Contaminant Deletion or Selection
7440382	Arsenic	5.4		10.3		mg/kg	006SB0A201	20/20	N/A	10.3	11.6	0.39	C	NO	BKG
7440393	Barium	78.9		398		mg/kg	006SB0A201	20/20	N/A	398	238	5375	N	NO	BSL
7440439	Cadmium	0.26		0.29		mg/kg	006SB0K101	2/20	0.23-0.25	0.29	N/A	39.1	N	NO	BSL
7440473	Chromium	8.6		14.7		mg/kg	006SB0L201	20/20	N/A	14.7	15.3	30.1	C	NO	BSL
7439921	Lead	7.4		13.8		mg/kg	006SB0A101	20/20	N/A	13.8	11.7	400		NO	BSL
72548	4,4'-DDD	16		120		ug/kg	006S00H101	9/33	7-270	120	N/A	2431	C	NO	BSL
72559	4,4'-DDE	4.4		73		ug/kg	006S00H101	10/33	2.7-98	73	N/A	1716	C	NO	BSL
50293	4,4'-DDT	21		200		ug/kg	006SB0H101	10/33	8-290	200	N/A	1716	C	NO	BSL
309002	**Aldrin**	**4.3**		**240**		**ug/kg**	**006SB0K201**	**8/33**	**2.7-98**	**240**	**N/A**	**28.4**	**C**	**YES**	**ASL**
319846	Alpha-BHC	2.7		3.6		ug/kg	006SB0G201	3/33	2-74	3.6	N/A	90.0	C	NO	BSL
319857	Beta-BHC	7		7		ug/kg	006SB0A101	1/33	4-150	7	N/A	315	C	NO	BSL
60571	**Dieldrin**	**5.5**		**78**		**ug/kg**	**006S00C201**	**9/33**	**1.3-49**	**78**	**N/A**	**30.2**	**C**	**YES**	**ASL**
72208	Endrin	22		63		ug/kg	006S00L101	3/33	4-150	63	N/A	18189	N	NO	BSL
72435	**Methoxychlor**	**210**		**340000**		**ug/kg**	**006S00H201**	**15/33**	**120-1500**	**340000**	**N/A**	**303147**	**N**	**YES**	**ASL**
8001352	**Toxaphene**	**2500**		**14000**		**ug/kg**	**006S00C101**	**2/33**	**160-5900**	**14000**	**N/A**	**439**	**C**	**YES**	**ASL**
95761	3,4-Dichloroaniline	84		4900		ug/kg	006SB0F201	5/20	760-20000	4900	N/A	242518		NO	BSL
100027	4-Nitrophenol	8100		8100		ug/kg	006SB0F101	1/33	1000-16500	8100	N/A	3759026	N	NO	BSL
56553	Benzo(a)anthracene	870		870		ug/kg	006S00B101	1/33	410-8000	870	N/A	617	C	NO	IFD
117817	bis(2-Ethylhexyl)phthalate	90		110		ug/kg	006SB0D101	3/33	410-8000	110	N/A	34530	C	NO	BSL
218019	Chrysene	870		870		ug/kg	006S00B101	1/33	410-8000	870	N/A	61689	C	NO	BSL
84742	Di-n-butylphthalate	98		200		ug/kg	006SB0K201	6/33	660-8000	200	N/A	6062944	N	NO	BSL
88857	**Dinoseb**	**430**		**160000**		**ug/kg**	**006S00B101**	**22/33**	**462-4200**	**160000**	**N/A**	**60629**	**N**	**YES**	**ASL**
78591	Isophorone	4500		4500		ug/kg	006SB0D201	1/33	410-8000	4500	N/A	508860	C	NO	BSL
108952	Phenol	6900		6900		ug/kg	006SB0D201	1/33	410-8000	6900	N/A	36377666	N	NO	BSL
709988	Propanil	103		18000		ug/kg	006SB0F201	5/20	760-5000	18000	N/A	303147	N	NO	BSL
107062	1,2-Dichloroethane	9		9		ug/kg	006SB0J301	2/20	6-29	9	N/A	341	C	NO	BSL
78933	2-Butanone (MEK)	3		93		ug/kg	006SB0F201	3/20	6-66	93	N/A	7020072	N	NO	BSL
591786	2-Hexanone	3		3		ug/kg	006SB0F201	1/20	57-290	3	N/A	110000	sat	NO	BSL
108101	4-Methyl-2-Pentanone (MIBK)	1		500		ug/kg	006SB0D201	3/20	57-290	500	N/A	760225	N	NO	BSL
67641	Acetone	5		1345		ug/kg	006SB0G101	14/20	12-13	1345	N/A	1485678	N	NO	BSL

(1) Minimum/maximum detected concentration.

(2) Background concentration calculated using the arithmetic mean plus two standard deviations.

(3) Residential soil screening values are from USEPA Region 6 Human Health Medium-Specific Screening Levels (USEPA, 1999). The screening value for 4-Chloroaniline was used as a surrogate for 3,4-dichloroaniline.

(4) Rationale Codes Selection Reason: Above Screening Levels (ASL)

Deletion Reason: Infrequent Detection (IFD)
Below Screening Level (BSL)
Background Screening Level (BKG)

Definitions:
N/A = Not Applicable
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement
C = Carcinogenic
N = Non-Carcinogenic
mg/kg = milligrams per kilogram
ug/kg = micrograms per kilogram

TABLE 8

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Current Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 8 Surface Soil

CAS Number	Chemical	Minimum Concentration (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value (2)	Screening Toxicity Value (3)	COPC Flag	Rationale for Contaminant Deletion or Selection (4)
7440382	Arsenic	4.2		6.3		mg/kg	008SHA0901	4/4	N/A	6.3	11.6	0.39 C	NO	BKG
7440393	Barium	77.6		248		mg/kg	008SHA0601	4/4	N/A	248	238	5375 N	NO	BSL
7440473	Chromium	16.5		22.9		mg/kg	008SHA0601	4/4	N/A	22.9	15.3	30.1 C	NO	BSL
7439921	Lead	9.4		12.5		mg/kg	008SHA0901	4/4	N/A	12.5	11.7	400	NO	BSL
7782492	Selenium	0.81		0.81		mg/kg	008SHA0801	1/4	0.62	0.81	N/A	391 N	NO	BSL
60571	Dieldrin	4		4		ug/kg	008SHA0701	1/4	1.6-1.7	4	N/A	30.2 C	NO	BSL

(1) Minimum/maximum detected concentration

(2) Background concentration calculated using the arithmetic mean plus two standard deviations

(3) Residential soil screening values are from USEPA Region 6 Human Health Medium-Specific Screening Levels (USEPA, 1999).

(4) Rationale Codes Deletion Reason: Background Levels (BKG)
Below Screening Level (BSL)

Definitions: N/A = Not Applicable
COPC = Chemical of Potential Concern
C = Carcinogenic
N = Non-Carcinogenic
mg/kg = milligrams per kilogram
ug/kg = micrograms per kilogram

TABLE 9
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Current Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 9 Surface Soil

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background (2) Value	Screening (3) Toxicity Value		COPC Flag	Rationale for (4) Contaminant Deletion or Selection
7440382	Arsenic	3.4		3.5		mg/kg	009SB00301	2/2	N/A	3.5	11.6	0.39	C	NO	BKG
7440393	Barium	94.1		99.8		mg/kg	009SB00301	2/2	N/A	99.8	238	5,375	N	NO	BSL
7440473	Chromium	11.3		14.7		mg/kg	009SB00301	2/2	N/A	14.7	15.3	30.1	C	NO	BSL
7439921	Lead	8.1		9		mg/kg	009SB00301	2/2	N/A	9	11.7	400		NO	BSL
72548	4,4'-DDD	24		24		ug/kg	009SB01501	1/2	**93**	24	N/A	2,431	C	NO	BSL
72559	4,4'-DDE	12		12		ug/kg	009SB01501	1/2	**34**	12	N/A	1,716	C	NO	BSL
50293	4,4'-DDT	15		15		ug/kg	009SB01501	1/2	**100**	15	N/A	1,716	C	NO	BSL
76448	**Heptachlor**	**150**		**150**		**ug/kg**	**009SB00301**	**1/2**	**2.1**	**150**	N/A	**107.4**	**C**	**YES**	**ASL**
95761	**3,4-Dichloroaniline**	**150**		**450,000**		**ug/kg**	**009SB00701**	**5/16**	**840-85,000,000**	**450,000**	N/A	**242517.77**	**N**	**YES**	**ASL**
88857	**Dinoseb**	**500**		**29,000,000**		**ug/kg**	**009SB00501**	**17/19**	**7-15,000,000**	**29,000,000**	N/A	**60,629**	**N**	**YES**	**ASL**
709988	**Propanil**	**860**		**4,000,000**		**ug/kg**	**009SB00401**	**5/16**	**720-85,000,000**	**4,000,000**	N/A	**303,147**	**N**	**YES**	**ASL**
107062	1,2-Dichloroethane	43		58		ug/kg	009S002001	2/5	5-130	58	N/A	341	C	NO	BSL
78933	2-Butanone (MEK)	22		36,000		ug/kg	009S002201	4/5	11-4,000	36,000	N/A	7,020,072	N	NO	BSL
108101	4-Methyl-2-Pentanone (MIBK)	12		63		ug/kg	009S002201	2/5	50-2,000	63	N/A	760,225	N	NO	BSL
67641	Acetone	300		200,000		ug/kg	009S002201	4/5	11-4,000	200,000	N/A	1,485,678	N	NO	BSL
100414	Ethylbenzene	10		10		ug/kg	009S002201	1/5	5-200	10	N/A	233,948	sat	NO	BSL
75092	Methylene chloride	92		94		ug/kg	009S002101	2/5	5-800	94	N/A	8,607	C	NO	BSL
108883	Toluene	10		61		ug/kg	009S002001	2/5	5-200	61	N/A	521,170	sat	NO	BSL
1330207	Xylene (total)	4		130		ug/kg	009S002201	2/5	5-200	130	N/A	214,480	sat	NO	BSL

(1) Minimum/maximum detected concentration.
(2) Background concentration calculated using the arithmetic mean plus two standard deviations.
(3) Residential soil screening values are from USEPA Region 6 Human Health Medium-Specific Screening Levels (USEPA, 1999).
The screening value for 4-chloroaniline was used as a surrogate for 3,4-dichloroaniline.
(4) Rationale Codes Selection Reason: Above Screening Levels (ASL)

Deletion Reason: Background Levels (BKG)
Below Screening Level (BSL)

Definitions:
N/A = Not Applicable
COPC = Chemical of Potential Concern
C = Carcinogenic
N = Non-Carcinogenic
sat = Screening level is based on the soil saturation equation (USEPA, 1999)

TABLE 10
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Subsurface Soil
Exposure Point:	Site 1 Subsurface Soil

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Screening (2) Toxicity Value MSSL	Screening (2) Toxicity Value SSL	COPC Flag	Rationale for (3) Contaminant Deletion or Selection
7440382	**Arsenic**	**1.6**		**44.6**		**mg/kg**	**001SHA0201**	**16/20**	**5 - 5**	**44.6**	**2**	**1533**	**YES**	**ASL**
7440439	Cadmium	0.29		0.29		mg/kg	001SMW0606	1/16	0.33 - 0.38	0.29	1019	395	NO	BSL
72548	4,4'-DDD	12		110		ug/kg	001SHA0101	6/25	7- 700	110	14158	27002	NO	BSL
72559	4,4'-DDE	3.8		98		ug/kg	001SHA0101	10/25	2.7- 270	98	9994	35922	NO	BSL
50293	4,4'-DDT	9.7		380		ug/kg	001SHA0101	3/25	8 - 800	380	9994	328988	NO	BSL
309002	Aldrin	22		22		ug/kg	001SHA0201	1/25	2.7- 150	22	103	405	NO	BSL
319857	Beta-BHC	47		510		ug/kg	001SHA0501	2/25	4 - 400	510	1663	184	NO	BSL
84742	**Dieldrin**	**593**		**593**		**ug/kg**	**001SHA0501**	**1/25**	**1.3 - 130**	**593**	**109**	**227**	**YES**	**ASL**
106467	1,4-Dichlorobenzene	260		260		ug/kg	001SHA0501	1/25	460 - 150000	260	6988	113450	NO	BSL
84742	Di-n-butylphthalate	120		750		ug/kg	001SHA0501	2/25	660 - 150000	750	62311299	12877220	NO	BSL
88857	Dinoseb	9600		9600		ug/kg	001SHA0101	1/25	462- 150000	9600	623113	19157	NO	BSL
129000	Pyrene	160		160		ug/kg	001SHA0201	1/25	460 - 150000	160	14976044	27175499	NO	BSL
107062	**1,2-Dichloroethane**	**16**		**7500**		**ug/kg**	**001SHA0501**	**3/20**	**5 - 6**	**7500**	**746**	**1467**	**YES**	**ASL**
78933	2-Butanone (MEK)	53		57		ug/kg	001SHA0401	2/20	11 - 100	57	26408664	418104	NO	BSL
107062	4-Methyl-2-Pentanone (MIBK)	92		92		ug/kg	001SHA0501	1/20	50 - 70	92	746	77644	NO	BSL
67641	Acetone	54		190		ug/kg	001SGB0101	5/20	11 - 100	190	5827279	128573	NO	BSL
67663	Chloroform	98		98		ug/kg	001SHA0501	1/20	5 - 7	98	521	55	NO	BSL
100414	Ethylbenzene	13		13		ug/kg	001SHA0501	1/20	5 - 7	13	233948	467460	NO	BSL
75092	Methylene chloride	6		33		ug/kg	001SMW0606	2/20	5 - 20	33	19378	1023	NO	BSL
127184	Tetrachloroethene	760		760		ug/kg	001SHA0501	1/20	5 - 7	760	13479	4176	NO	BSL
108883	Toluene	2		930		ug/kg	001SHA0501	3/20	5 - 7	930	521170	528774	NO	BSL

(1) Minimum/maximum detected concentration.
(2) Industrial soil screening values are from EPA Region 6 Human Health Medium-Specific Screening Levels (October, 1999).
(3) Rationale Codes Selection Reason: Above Screening Levels (ASL)
Deletion Reason: Below Screening Level (BSL)

Definitions:
N/A = Not Applicable
COPC = Chemical of Potential Concern
mg/kg = milligrams per kilogram
ug/kg = micrograms per kilogram

TABLE 11
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Subsurface Soil
Exposure Point:	Site 2 Subsurface Soil

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Screening (2) Toxicity Value MSSL	SSL	COPC Flag	Rationale for (3) Contaminant Deletion or Selection
7440382	**Arsenic**	**3.4**		**59**		**mg/kg**	**IMSB-1 (1-3')**	**43/53**	**0.2-5**	**59**	**2**	**1533**	**YES**	**ASL**
7440393	Barium	81.7		313		mg/kg	IMSB-1 (1-3')	43/43	NA	313	100000	86520	NO	BSL
7440439	Cadmium	0.25		161.8		mg/kg	2HA-5 (0-1')	17/43	0.24-0.4	161.8	1019	395	NO	BSL
7440473	**Chromium**	**8.2**		**95.3**		**mg/kg**	**2HA-5 (0-1')**	**43/43**	**NA**	**95.3**	**64**	**2016**	**YES**	**ASL**
7439921	Lead	6.5		65.9		mg/kg	2HA-5 (0-1')	43/43	NA	65.9	2000	19	NO	BSL
7439976	**Mercury**	**111.7**		**111.7**		**mg/kg**	**2HA-5 (0-1')**	**1/43**	**0.1-0.14**	**111.7**	**23**	**110**	**YES**	**ASL**
7782492	Selenium	0.15		70.9		mg/kg	2HA-5 (0-1')	10/43	0.12-0.75	70.9	10220	273	NO	BSL
7440224	Silver	89.9		89.9		mg/kg	2HA-5 (0-1')	1/43	0.36-0.93	89.9	10220	1629	NO	BSL
72548	4,4'-DDD	10		180		ug/kg	2SB-6 (21-22')	4/58	0.0006-9300	180	14158	27002	NO	BSL
72559	4,4'-DDE	11		190		ug/kg	IMSB-1 (1-3')	2/59	0.0002-3400	190	9994	35922	NO	BSL
50293	4,4'-DDT	11		890		ug/kg	IMSB-1 (1-3')	7/58	0.0006-10000	890	9994	328988	NO	BSL
309002	**Aldrin**	**9.3**		**500**		**ug/kg**	**2SB-6 (28-29')**	**7/59**	**0.0002-3400**	**500**	**103**	**405**	**YES**	**ASL**
319846	Alpha-BHC	4.4		210		ug/kg	2SB-6 (28-29')	7/58	0.0002-2500	210	475	43	NO	BSL
319857	Beta-BHC	7.2		37		ug/kg	IMSB-3 (5-10')	3/58	0.0003-5100	37	1663	184	NO	BSL
319868	Delta-BHC	26		26		ug/kg	IMSB-1 (8-12')	1/59	0.0004-7600	26	475	1176	NO	BSL
60571	**Dieldrin**	**7.4**		**350**		**ug/kg**	**IMSB-2 (10-15')**	**5/58**	**0.0001-1700**	**350**	**109**	**227**	**YES**	**ASL**
1031078	Endosulfan Sulfate	17		17		ug/kg	2SB-15 (8-10')	1/58	0.0033-56000	17	469268	984195	NO	BSL
72208	Endrin	7		680		ug/kg	2SB-6 (28-29')	5/58	0.0003-5100	680	23463	48392	NO	BSL
53494705	Endrin ketone	6.4		6.4		ug/kg	2SB-15 (8-10')	1/48	3.8-20000	6	23463	48392	NO	BSL
58899	gamma-BHC (Lindane)	3.4		3.4		ug/kg	IMSB-3 (5-10')	2/59	0.0002-3400	3.4	2302	662	NO	BSL
5103742	gamma-Chlordane	150		150		ug/kg	2SB-6 (21-22')	1/45	11-12000	150	1829	217972	NO	BSL
76448	Heptachlor	4.9		270		ug/kg	2SB-6 (28-29')	5/58	0.0001-2500	270	388	2136	NO	BSL
72435	Methoxychlor	55		340000		ug/kg	2SB-9 (26-27')	20/58	0.009-34000	340,000	3115565	6728402	NO	BSL
120821	1,2,4-Trichlorobenzene	1200		1200		ug/kg	2SB-10 (15-20')	1/57	0.05-44000	1,200	3019460	258944	NO	BSL
95501	1,2-Dichlorobenzene	150		12000		ug/kg	2SB-9 (26-27')	5/57	0.05-44000	12,000	372612	374949	NO	BSL
91587	2-Chloronaphthalene	72		5400		ug/kg	2SB-12 (15-20')	4/57	0.05-44000	5,400	19790689	1686863	NO	BSL
88755	2-Nitrophenol	53		2900		ug/kg	2SB-10 (15-20')	8/57	0.05-44000	2900	4849101	2161413	NO	BSL
95761	3,4-Dichloroaniline	250		6700		ug/kg	IMSB-2 (5-10')	6/47	430-110000	6,700	312845	90459	NO	BSL
100027	4-Nitrophenol	46		25000		ug/kg	2SB-3 (13-14')	21/57	0.25-20000	25,000	38633005	2549684	NO	BSL
65850	Benzoic acid	540		540		ug/kg	2MW-1 (20-25')	1/33	0.25-4500	540	100000000	40471385	NO	BSL
111444	bis(2-Chloroethyl)ether	180		180		ug/kg	2SB-12 (25-30')	1/57	0.05-44000	180	488	4	NO	BSL
84742	Di-n-butylphthalate	53		3200		ug/kg	2SB-12 (15-20')	13/57	0.05-44000	3200	62311299	12877220	NO	BSL
88857	Dinoseb	1.1		100000		ug/kg	2MW-5 (0-1')	16/57	0.35-17000	100,000	623113	19157	NO	BSL
108952	Phenol	170		100000		ug/kg	2SB-12 (15-20')	20/57	0.05-44000	100000	100000000	5398264	NO	BSL
709988	Propanil	90		79000		ug/kg	2SB-12 (15-20')	28/47	840-4400	79,000	3115565	122640	NO	BSL
107062	**1,2-Dichloroethane**	**10**		**170000**		**ug/kg**	**2SB-6 (28-29')**	**28/53**	**0.05-8300**	**170,000**	**746**	**1467**	**YES**	**ASL**
78875	1,2-Dichloropropane	32		32		ug/kg	2SB-5 (15-20')	1/53	0.05-89000	32	754	1596	NO	BSL
78933	2-Butanone (MEK)	21		1700		ug/kg	2SB-10 (15-20')	5/53	1-180000	1,700	26408664	418104	NO	BSL
108101	4-Methyl-2-Pentanone (MIBK)	9		1200		ug/kg	2SB-3 (24-25')	13/53	0.5-890000	1,200	2780710	77644	NO	BSL
67641	Acetone	13		17000		ug/kg	2SB-11 (25-30')	28/53	1-180000	17,000	5827279	128573	NO	BSL
56235	Carbon tetrachloride	670		670		ug/kg	2SB-9 (26-27')	1/53	0.05-89000	670	516	3213	NO	SDE

TABLE 11
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Subsurface Soil
Exposure Point:	Site 2 Subsurface Soil

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Screening (2) Toxicity Value MSSL	Screening (2) Toxicity Value SSL	COPC Flag	Rationale for (3) Contaminant Deletion or Selection
108907	Chlorobenzene	3		530		ug/kg	2SB-9 (26-27')	7/53	0.05-89000	530	182630	27393	NO	BSL
67663	**Chloroform**	**2**		**13000**		**ug/kg**	**2SB-9 (26-27')**	**17/53**	**0.05-89000**	**13,000**	**521**	**55**	**YES**	**ASL**
100414	Ethylbenzene	1		620		ug/kg	2SB-3 (24-25')	7/53	0.05-89000	620	233948	467460	NO	BSL
75092	**Methylene chloride**	**12**		**380000**		**ug/kg**	**2SB-5 (25-30')**	**31/53**	**0.2-8300**	**380,000**	**19378**	**1023**	**YES**	**ASL**
108883	Toluene	3		390000		ug/kg	2SB-10 (15-20')	19/53	0.05-89000	390,000	521170	528774	NO	BSL
1330207	Xylene (total)	3		4800		ug/kg	2SB-6 (28-29')	14/53	0.05-89000	4,800	214480	1052723	NO	BSL

(1) Minimum/maximum detected concentration.
(2) Industrial soil screening values are from USEPA Region 6 Human Health Medium-Specific Screening Levels (USEPA, 1999).
- Alpha-BHC was used for Delta-BHC
- Endosulfan was used for endosulfan sulfate
- Endrin was used for endrin ketone
- Chlordane was used for gamma-chlordane
- 4-Chloroaniline was used for 3,4-dichloroaniline

(3) Rationale Codes Selection Reason: Above Screening Levels (ASL)

Deletion Below Screening Level (BSL)
Sample Depth Exceedance (SDE)

(4) Although the carbon tetrachloride concentrations exceeds screening levels, it was not selected as a COPC because the depth at which the concentrations were detected exceeded 10 feet. Hypothetical receptors for the Cedar facility would not be exposed to depths beyond 10 feet.

Definitions:
N/A = Not Applicable
COPC = Chemicals of Potential Concern
C = Carcinogen
N = Noncarcinogen
mg/kg = milligrams per kilogram
ug/kg = micrograms per kilogram
sat = Screening level is based on the soil saturation equation (USEPA, 1999).

TABLE 12
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Subsurface Soil
Exposure Point:	Site 3 Subsurface Soil

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Screening (3) Toxicity Value	COPC Flag	Rationale for (4) Contaminant Deletion or Selection
88857	Dinoseb	630		13,000,000		ug/kg	003SLB0602	5/5	N/A	13,000,000	1,068,868 19157	YES	ASL

(1) Minimum/maximum detected concentration.
(2) Industrial soil screening values are from USEPA Region 6 Human Health Medium-Specific Screening Levels (USEPA, 1999).
(3) Rationale Codes Selection Reason: Above Screening Levels (ASL)

Definitions:
N/A = Not Applicable
COPC = Chemical of Potential Concern
C = Carcinogenic
N = Non-Carcinogenic
ug/kg = micrograms per kilogram

TABLE 13
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Subsurface Soil
Exposure Point:	Site 4 Subsurface Soil

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Screening (2) Toxicity Value		COPC Flag	Rationale for (3) Contaminant Deletion or Selection
7440382	**Arsenic**	**1.3**		**15.5**		**mg/kg**	**4MW-1 (25-30')**	**16/16**	**N/A - N/A**	**15.5**	**3**	**1533**	**YES**	**ASL**
7440393	Barium	72.6		218		mg/kg	4MW-1 (10-15')	16/16	N/A - N/A	218	100000	86520	NO	BSL
7440473	Chromium	8.6		20.9		mg/kg	4HA-6 (1-2')	16/16	N/A - N/A	20.9	64	2016	NO	BSL
7439921	Lead	6.9		30		mg/kg	4MW-1 (10-15')	16/16	N/A - N/A	30	2000	19	NO	BSL
7782492	Selenium	0.64		0.64		mg/kg	4MW-2 (25-30')	1/16	0.56 - 0.65	0.64	9366	273	NO	BSL
72548	4,4'-DDD	26		350		ug/kg	4SB-2 (0-2')	8/41	7 - 430	350	18719	27002	NO	BSL
72559	4,4'-DDE	5.2		280		ug/kg	4HA-4 (1-2')	16/41	2.7 - 160	280	132147	35922	NO	BSL
50293	4,4'-DDT	19		450		ug/kg	4HA-6 (1-2')	8/41	8 - 470	450	13214	328988	NO	BSL
319846	Alpha-BHC	8.1		14		ug/kg	4HA-6 (0-1')	2/41	2 - 120	14	665	43	NO	BSL
319857	Beta-BHC	5.1		38		ug/kg	4HA-5 (2-3')	2/41	4 - 230	38	23292	184	NO	BSL
60571	**Dieldrin**	**1.6**		**630**		**ug/kg**	**4HA-6 (1-2')**	**6/41**	**1.3 - 78**	**630**	**187**	**227**	**YES**	**ASL**
959988	Endosulfan I	32		32		ug/kg	4HA-6 (0-1')	1/41	9.4 - 550	32	6413206	984195	NO	BSL
33213659	Endosulfan II	3.4		72		ug/kg	4HA-2 (1-2')	2/41	2.7 - 160	72	6413206	984195	NO	BSL
53494705	Endrin ketone	770		770		ug/kg	4HA-2 (1-2')	1/25	17 - 940	770	320660	48392	NO	BSL
	Heptachlor	12		12		ug/kg	4HA-5 (0-1')	1/41	2 - 120	12	665	2136	NO	BSL
72435	Methoxychlor	120		74,000		ug/kg	4HA-2 (1-2')	19/41	120 - 1,200	74,000	534434	6728402	NO	BSL
120821	1,2,4-Trichlorobenzene	470		470		ug/kg	4HA-4 (1-2')	1/41	430 - 1,400,000	470	3019460	258944	NO	BSL
95501	1,2-Dichlorobenzene	120		3,700		ug/kg	4HA-6 (0-1')	5/41	350 - 1,400,000	3,700	372612	374949	NO	BSL
95487	2-Methylphenol (o-Cresol)	2		2		ug/kg	4MW-1 (25-30')	1/41	430 - 1,400,000	2	5344339	757787	NO	BSL
95761	**3,4-Dichloroaniline**	**12**		**12,000,000**		**ug/kg**	**4HA-6 (1-2')**	**8/25**	**690 - 37000**	**12,000,000**	**427547**	**90459**	**YES**	**ASL**
106478	4-Chloroaniline	2,800		12,000		ug/kg	4HA-4 (1-2')	4/41	430 - 2,700,000	12,000	427547	174462	NO	BSL
100027	4-Nitrophenol	2		2		ug/kg	4MW-1 (25-30')	1/41	1000 - 6,800,000	2	6626980	2549684	NO	BSL
84742	Di-n-butylphthalate	400		2,700		ug/kg	4HA-2 (1-2')	4/41	430 - 1,400,000	2,700	100000000	12877220	NO	BSL
117840	Di-n-octylphthalate	4,300		4,300		ug/kg	4HA-5 (1-2')	1/41	430 - 1,400,000	4,300	2137735	935283301	NO	BSL
131113	Dimethylphthalate	94		180		ug/kg	4HA-7 (5-6')	3/41	430 - 1,400,000	180	100000000	8646184	NO	BSL
88857	**Dinoseb**	**45**		**1,100,000**		**ug/kg**	**4HA-2 (1-2')**	**22/41**	**462 - 1,400,000**	**1,100,000**	**106887**	**19157**	**YES**	**ASL**
206440	Fluoranthene	130		130		ug/kg	4HA-4 (1-2')	1/41	430 - 1,400,000	130	3740329	151868230	NO	BSL
78591	Isophorone	730		15,000		ug/kg	4SB-3 (6-8')	3/41	430 - 1,400,000	15,000	31503470	19352	NO	BSL
108952	Phenol	7		7		ug/kg	4MW-1 (25-30')	1/41	430 - 1,400,000	7	100000000	5398264	NO	BSL
709988	Propanil	64		130,000		ug/kg	4HA-5 (2-3')	6/25	690 - 1400000	130,000	534434	122640	NO	BSL
129000	Pyrene	110		110		ug/kg	4HA-4 (1-2')	1/41	430 - 1,400,000	110	3647509	27175499	NO	BSL
117817	bis(2-Ethylhexyl)phthalate	1,200		1,300		ug/kg	4HA-5 (1-2')	2/41	430 - 1,400,000	1,300	213774	1441906	NO	BSL
75354	1,1-Dichloroethene	2		2		ug/kg	4HA-4 (2-3')	1/35	5 - 33	2	1176	3107	NO	BSL
107062	**1,2-Dichloroethane**	**9.9**		**820**		**ug/kg**	**4MW-3 (33-38')**	**10/35**	**5 - 29**	**820**	**758**	**1467**	**YES**	**ASL**
78933	2-Butanone (MEK)	9		130		ug/kg	4SB-1 (0-2')	10/35	11 - 100	130	2721022	418104	NO	BSL
108101	4-Methyl-2-Pentanone (MIBK)	19		120		ug/kg	4HA-5 (2-3')	6/35	50 - 170	120	284694	77644	NO	BSL
67641	Acetone	12		4,400		ug/kg	4SB-1 (8-10')	18/35	11 - 100	4,400	606377	128573	NO	BSL
71432	Benzene	2		29		ug/kg	4MW-1 (10-15')	2/35	5 - 33	29	1359	1805	NO	BSL

TABLE 13
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Subsurface Soil
Exposure Point:	Site 4 Subsurface Soil

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Screening (2) Toxicity Value		COPC Flag	Rationale for (3) Contaminant Deletion or Selection
75150	Carbon disulfide	16		120		ug/kg	4HA-2 (1-2')	3/35	5 - 100	120	721254	436977	NO	BSL
108907	Chlorobenzene	3		35		ug/kg	4HA-5 (2-3')	4/35	5 - 33	35	18375	27393	NO	BSL
67663	Chloroform	12		25 5		ug/kg	4HA-4 (2-3')	2/35	5 - 33	25 5	522	55	NO	BSL
100414	Ethylbenzene	4		150		ug/kg	4HA-2 (1-2')	8/35	5 - 33	150	233948	467460	NO	BSL
75092	Methylene chloride	1		270		ug/kg	4MW-1 (25-30')	6/35	5 - 29	270	20075	1023	NO	BSL
108883	Toluene	2		56,000		ug/kg	4MW-1 (10-15')	16/35	5 - 7	56,000	521170	528774	NO	BSL

(1) Minimum/maximum detected concentration

(2) Industrial soil screening values are from USEPA Region 6 Human Health Medium-Specific Screening Levels (USEPA, 1999)
-The following surrogate screening values were used:
-Endosulfan was used for Endosulfan I and Endosulfan II
-Endrin was used for endrin ketone
-4-Chloroaniline was used for 3,4-dichloroanaline

(3) Rationale Codes Selection Reason: Infrequent Detection but Associated Historically (HIST)

Deletion Reason: Below Screening Level (BSL)

Definitions:
N/A = Not Applicable
COPC = Chemical of Potential Concern
C = Carcinogenic
N = Non-Carcinogenic
mg/kg = milligrams per kilogram
ug/kg = micrograms per kilogram

TABLE 14
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Subsurface Soil
Exposure Point:	Site 5 Subsurface Soil

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Screening (2) Toxicity Value		COPC Flag	Rationale for (3) Contaminant Deletion or Selection
7440382	Arsenic	7.4		9.7		mg/kg	005SB00302	6/6	N/A	9.7	3	1533	NO	SDE
7440393	Barium	126		168		mg/kg	005SB00201	6/6	N/A	168	100000	86520	NO	BSL
7440439	Cadmium	0.4		0.4		mg/kg	005SB000302	1/6	0.25 - 0.38	0.4	934	395	NO	BSL
7440473	Chromium	9.1		11.7		mg/kg	005SB00201	6/6	N/A	11.7	64	2016	NO	BSL
7439921	Lead	8.3		10.4		mg/kg	005SB00102	6/6	N/A	10.4	2000	19	NO	BSL
319846	Alpha-BHC	3.7		6.8		ug/kg	005SB00202	2/6	2.5 - 2.6	6.8	665	43	NO	BSL
33213659	Endosulfan II	5.9		12		ug/kg	005SB00201	2/6	3.3 - 3.4	12	6413206	984195	NO	BSL
58899	gamma-BHC (Lindane)	6.2		6.2		ug/kg	005SB00202	1/6	3.3 - 3.4	6.2	3225	662	NO	BSL
51285	2,4-Dinitrophenol	23,000		49,000		ug/kg	005SB00202	2/6	4200 - 4300	49,000	213774	45990	NO	BSL
95761	3,4-Dichloroaniline	1,200		1200		ug/kg	005SB00102	1/6	820 - 860	1200	427547	90459	NO	BSL
534521	4,6-Dinitro-2-methylphenol	200		200		ug/kg	005SB00201	1/6	4200 - 4300	200	N/A	105777	NO	BSL
88857	Dinoseb	57,000		170,000		ug/kg	005SB00201	2/6	4200 - 4300	170,000	106887	19157	NO	SDE
107062	1,2-Dichloroethane	4		4		ug/kg	005SB00302	1/6	6 - 820	4	758	1467	NO	BSL
78933	2-Butanone (MEK)	120		44,000		ug/kg	005SB00202	3/6	12 -13	44,000	2721022	418104	NO	BSL
108101	4-Methyl-2-Pentanone (MIBK)	1		170		ug/kg	005SB00302	3/6	59 - 8200	170	284694	77644	NO	BSL
67641	Acetone	3,900		21,000		ug/kg	005SB00302	3/6	12 - 13	21,000	606377	128573	NO	BSL
67663	Chloroform	4		4		ug/kg	005SB00302	1/6	6 - 820	4	522	55	NO	BSL
100414	Ethylbenzene	3		3		ug/kg	005SB00201	1/6	6 - 820	3	233948	467460	NO	BSL
75092	Methylene chloride	8		140		ug/kg	005SB00102	5/6	820 - 820	140	20075	1023	NO	BSL

(1) Minimum/maximum detected concentration.

(2) Industrial soil screening values are from USEPA Region 6 Human Health Medium-Specific Screening Levels (USEPA, 1999)
The following surrogate screening values were used:
-Endosulfan was used for Endosulfan II
-4-Chloroaniline was used for 3,4-dichloroaniline

(3) Rationale Codes Selection Reason: Above Screening Levels (ASL)

Deletion Reason: Below Screening Level (BSL)
Sample Depth Exceedance (SDE)

(4) Although arsenic and dinoseb concentrations were greater than their screening levels, neither were selected as COPCs because the depth at which the concentrations were detected exceeded 10 feet. Hypothetical receptors for the Cedar facility would not be exposed to depths beyond 10 feet.

Definitions:
N/A = Not Applicable
COPC = Chemical of Potential Concern
C = Carcinogenic
N = Non-Carcinogenic

TABLE 15

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Subsurface Soil
Exposure Point:	Site 9 Subsurface Soil

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Screening (2) Toxicity Value		COPC Flag	Rationale for (3) Contaminant Deletion or Selection
7440382	**Arsenic**	**3.4**		**7.3**		**mg/kg**	**009SB00302**	**4/4**	**N/A**	**7.3**	**3**	**1533**	**YES**	**ASL**
7440393	Barium	94.1		150		mg/kg	009SB00302	4/4	N/A	150	100000	86520	NO	BSL
7440473	Chromium	10.8		14.7		mg/kg	009SB00301	4/4	N/A	14.7	64	2016	NO	BSL
7439921	Lead	8.1		11.2		mg/kg	009SB00302	4/4	N/A	11.2	2000	19	NO	BSL
72548	4,4- DDD	24		24		ug/kg	009SB01501	1/4	9 - 4	24	18719	27002	NO	BSL
72559	4,4-DDE	12		12		ug/kg	009SB01501	1/4	3 - 4	12	13214	35922	NO	BSL
50293	4,4-DDT	15		15		ug/kg	009SB01501	1/4	10 - 4	15	13214	328988	NO	BSL
75448	Heptachlor	150		150		ug/kg	009SB00301	1/4	2 - 4	150	665	2136	NO	BSL
51285	2,4-Dinitrophenol	3,400		3,400		ug/kg	009SB00202	1/45	3300 - 45	3,400	213774	45990	NO	BSL
95761	**3,4-Dichloroaniline**	**130**		**450000**		**ug/kg**	**009SB00701**	**7/36**	**840 - 36**	**450000**	**427547**	**90459**	**YES**	**ASL**
88857	**Dinoseb**	**500**		**29,000,000**		**ug/kg**	**009SB00501**	**39/45**	**462 - 45**	**29,000,000**	**106887**	**19157**	**YES**	**ASL**
709988	**Propanil**	**150**		**4,000,000**		**ug/kg**	**009SB00401**	**11/36**	**720 - 36**	**4,000,000**	**534434**	**122640**	**YES**	**ASL**
107062	1,2-Dichloroethane	43		730		ug/kg	009S002004	4/13	5 -13	730	758	1467	NO	BSL
78933	2-Butanone (MEK)	22		36,000		ug/kg	009S002201	8/13	11 - 13	36,000	2721022	418104	NO	BSL
108101	4-Methyl-2-Pentanone (MIBK)	12		63		ug/kg	009S002201	3/13	50 - 13	63	284694	77644	NO	BSL

(1) Minimum/maximum detected concentration.

(2) Industrial soil screening values are from USEPA Region 6 Human Health Medium-Specific Screening Levels (USEPA, 1999). The screening value for 4-chloroaniline was used as a surrogate for 3,4-dichloroaniline.

(3) Rationale Codes Selection Reason: Above Screening Levels (ASL)

Deletion Reason: Below Screening Level (BSL)

Definitions:
N/A = Not Applicable
COPC = Chemical of Potential Concern
C = Carcinogenic
N = Non-Carcinogenic
mg/kg = milligrams per kilogram
ug/kg = micrograms per kilogram
sat = screening level based on the soil saturation equation

TABLE 16
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Current
Medium:	Groundwater
Exposure Medium:	Groundwater
Exposure Point:	Perched Groundwater

CAS Number	Chemical	Minimum [1] Concentration	Minimum Qualifier	Maximum [1] Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Screening [2] Toxicity Value	COPC Flag	Rationale for [3] Contaminant Deletion or Selection
7440382	**Arsenic**	13.5		60		µg/L	2MW-2	9/9	N/A	60	0.09 C	YES	ASL
7440393	**Barium**	324		2,400		µg/L	EMW-4	9/9	N/A	2,400	2000 N	YES	ASL
7440439	**Cadmium**	3.6		16		µg/L	EMW-6B	4/9	3	16	5 N	YES	ASL
7440473	**Chromium**	21.2		226		µg/L	EMW-4	9/9	N/A	226	100 N	YES	ASL
7439896	Iron	22,500		347,000		µg/L	EMW-4	9/9	N/A	347,000	21900 N	NO	EN
7439921	**Lead**	10.8		174		µg/L	EMW-4	9/9	N/A	174	15 N	YES	ASL
7439976	Mercury	0.23		0.23		µg/L	2MW-2	1/9	0.2	0.23	2 N	NO	BSL
7782492	Selenium	5		5		µg/L	2MW-2	1/9	5	5	50 N	NO	BSL
50293	**4,4'-DDT**	0.49		1		µg/L	EMW-4	2/10	0.12-0.13	0.56	0.395 C	YES	HIST
319846	**Alpha-BHC**	0.05		0.05		µg/L	EMW-1	1/10	0.03	0.05	0.021 C	YES	HIST
72435	Methoxychlor	3.4		3		µg/L	2MW-1	1/10	1.8-1.9	3.4	40 N	NO	BSL
95501	1,2-Dichlorobenzene	7		130		µg/L	EMW-6B	4/9	10	130	600 N	NO	BSL
541731	1,3-Dichlorobenzene	3.5		4		µg/L	1MW-3	1/9	10-50	3.5	5 N	NO	BSL
106467	**1,4-Dichlorobenzene**	4		4		µg/L	1MW-3	1/9	10-50	4	2 C	YES	ASL
606202	**2,6-Dinitrotoluene**	320		320		µg/L	1MW-5	1/9	10-50	320	73 N	YES	ASL
91576	2-Methylnaphthalene	6		6		µg/L	EMW-6B	1/9	10	6.0	188 N	NO	BSL
95487	2-Methylphenol (o-Cresol)	2		2		µg/L	EMW-1	1/9	10-50	2.0	3650 N	NO	BSL
95761	**3,4-Dichloroaniline**	12		58,000		µg/L	EMW-6B	5/9	10-63	58,000	292 N	YES	NTX
106478	**4-Chloroaniline**	1		5,900		µg/L	EMW-6B	4/9	10	5,900	292 N	YES	ASL
84742	Di-n-butylphthalate	1.5		2		µg/L	1MW-5	2/9	10-50	2	7300 N	NO	BSL
131113	Dimethylphthalate	10		10		µg/L	EMW-1	1/9	10-50	10	730000 N	NO	BSL
88857	**Dinoseb**	42		42		µg/L	EMW-1	1/9	50-250	42	7 N	YES	ASL
91203	Naphthalene	15		15		µg/L	EMW-6B	1/9	10	15	25 N	NO	BSL
108952	Phenol	1		1		µg/L	EMW-4	1/9	10-50	1	43800 N	NO	BSL
709988	Propanil	10		18		µg/L	EMW-6B	2/9	10	18	365 N	NO	BSL
111444	**bis(2-Chloroethyl)ether**	5		5		µg/L	EMW-4	1/9	10-50	5	0.039 C	YES	ASL
107062	**1,2-Dichloroethane**	19		29,000		µg/L	2MW-1	7/10	5	29,000	0.49 C	YES	ASL
108101	**4-Methyl-2-Pentanone (MIBK)**	2,200		2,200		µg/L	2MW-1	1/10	50-1000	2,200	631 N	YES	ASL
67641	**Acetone**	4,800		4,800		µg/L	2MW-1	1/10	10-200	4,800	2433 N	YES	ASL
71432	**Benzene**	17		17		µg/L	EMW-6B	1/10	5-2500	17	1.5 C	YES	ASL
108907	Chlorobenzene	16		30		µg/L	EMW-6B	2/10	5-2500	30	100 N	NO	BSL
67663	**Chloroform**	1		700		µg/L	2MW-1	4/10	5-100	700	0.66 C	YES	ASL

TABLE 16
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Current
Medium:	Groundwater
Exposure Medium:	Groundwater
Exposure Point:	Perched Groundwater

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Screening (2) Toxicity Value		COPC Flag	Rationale for (3) Contaminant Deletion or Selection
75092	**Methylene chloride**	**600,000**		**600,000**		**µg/L**	**2MW-1**	**1/10**	**5-100**	**600,000**	**5**	**C**	**YES**	**ASL**
108883	Toluene	940		940		µg/L	2MW-1	1/10	5-100	940	1000	N	NO	BSL
79016	**Trichloroethene**	**28**		**28**		**µg/L**	**1MW-4**	**1/10**	**5-2500**	**28**	**5**	**C**	**YES**	**ASL**
1330207	Xylene (total)	1,100		1,100		µg/L	2MW-1	1/10	5-100	1,100	2863	N	NO	BSL

(1) Minimum/maximum detected concentration

(2) Screening values are from EPA Region 6 Human Health Medium-Specific Screening Levels (October, 1999) modified using Region 4 PRE Guidance (USEPA, 1994). To convert residential screening values to industrial screening values, residential screening levels for volatile organic compounds are divided by 0.25. All other chemicals are divided by 0.5 to obtain the industrial screening value.

(3) Rationale Codes Selection Reason: Infrequent Detection but Associated Historically (HIST)
Above Screening Levels (ASL)
Deletion Reason: No Toxicity Information (NTX)
Below Screening Level (BSL)

Definitions: N/A = Not Applicable
COPC = Chemical of Potential Concern
C = Carcinogenic
N = Non-Carcinogenic
µg/L = micrograms per liter

TABLE 17

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Current
Medium:	Groundwater
Exposure Medium:	Groundwater
Exposure Point:	Alluvial Groundwater

CAS Number	Chemical	Minimum [1] Concentration	Minimum Qualifier	Maximum [1] Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequenc	Range of Detection Limits	Concentration Used for Screening	Screening [2] Toxicity Value		COPC Flag	Rationale for [3] Contaminant Deletion or Selection
79005	1,1,2-Trichloroethane	27		27		µg/L	4MW-3	1/75	5 - 5000	27	0.8	C	YES	ASL
95501	1,2-Dichlorobenzene	17		76		µg/L	4MW-2	2/21	10	76	1481	N	NO	BSL
107062	1,2-Dichloroethane	6		87,000		µg/L	EMW-7	43/75	5 - 10	87,000	0.49	C	YES	ASL
78875	1,2-Dichloropropane	43		43		µg/L	4MW-3	1/75	5 -5000	43	0.66	C	YES	ASL
78933	2-Butanone (MEK)	13		77		µg/L	OFFMW-2	2/75	10 - 50000	77	21900	N	NO	BSL
108101	4-Methyl-2-Pentanone (MIBK)	11		2,500		µg/L	2MW-3	4/75	10 - 50000	2,500	631	N	YES	ASL
67641	Acetone	43		2,000		µg/L	2MW-3	12/75	10 - 50000	2,000	2433	N	NO	BSL
71432	Benzene	7		46		µg/L	4MW-2	2/75	5 -5000	46	0.72	C	YES	ASL
75274	Bromodichloromethane	6		6		µg/L	EMW-7	1/75	5 - 5000	6	0.72	C	YES	ASL
75252	Bromoform	11		11		µg/L	4MW-4	1/75	5 - 5000	11	0.00	N	YES	ASL
75150	Carbon disulfide	14		14		µg/L	4MW-2	1/75	5 - 50000	14	4171	N	NO	BSL
108907	Chlorobenzene	10		470		µg/L	2MW-4	6/75	5 - 5000	470	158	N	YES	ASL
75003	Chloroethane	79		79		µg/L	2MW-3	1/75	10 - 10000	79	34353	N	NO	BSL
67663	Chloroform	3		1,400		µg/L	4MW-2	8/75	5 - 5000	1,400	0.66	C	YES	ASL
124481	Dibromochloromethane	13		13		µg/L	4MW-4	1/75	5 - 5000	13	0.53	C	YES	ASL
100414	Ethylbenzene	54		54		µg/L	EMW-3	1/75	5 - 5000	54	700	N	NO	BSL
75092	Methylene chloride	130		5,000		µg/L	9GB-21 (30')	10/75	5 - 10000	5,000	17.10	C	YES	ASL
108883	Toluene	21		140,000		µg/L	4MW-1	8/75	5 - 2500	140,000	1000	N	YES	ASL
108054	Vinyl acetate	10		10		µg/L	EMW-7	1/75	5 - 25000	10	1650	N	NO	BSL
1330207	Xylene (total)	4		1,400		µg/L	4MW-1	7/75	5 - 2500	1,400	5725	N	NO	BSL
95476	o-Xylene	10		10		µg/L	EMW-7	1/21	10	10	5725	N	NO	BSL
156605	trans-1,2-Dichloroethene	10		10		µg/L	EMW-7	1/64	5 - 2500	10	100	N	NO	BSL

(1) Minimum/maximum detected concentration.

(2) Concentration used for screening are the more stringent of calculated industrial tapwater MSSL or MCLs (USEPA, 1996). Guidance for calculating industrial MSSLs is provided in Table 1 and Appendix C.

(3) Rationale Codes Selection Reason: Above Screening Levels (ASL)

Deletion Reason: Below Screening Level (BSL)

Definitions:
N/A = Not Applicable
COPC = Chemical of Potential Concern
C = Carcinogenic
N = Non-Carcinogenic
µg/L = micrograms per liter

TABLE 18
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Sediment
Exposure Medium:	Sediment
Exposure Point:	Site 1

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Screening (2) Toxicity Value	COPC Flag	Rationale for (3) Contaminant Deletion or Selection
7440382	**Arsenic**	**19**		**123**		**mg/kg**	**1SED-3**	**3/3**	**N/A**	**123**	**0.39 C**	**YES**	**ASL**
7440393	Barium	27.8		69.2		mg/kg	1SED-3	3/3	N/A	69.2	5,155 N	NO	BSL
7440439	Cadmium	0.63		0.94		mg/kg	1SED-1	2/3	0.37	0.94	3.91 N	NO	BSL
7440473	**Chromium**	**16.7**		**82**		**mg/kg**	**1SED-3**	**3/3**	**N/A**	**82**	**30 C**	**YES**	**ASL**
7439921	Lead	11.4		15.9		mg/kg	1SED-1	3/3	N/A	15.9	400	NO	BSL
7439976	Mercury	2.7		3.3		mg/kg	1SED-3	2/3	0.12	3.3	22 N	NO	BSL
7440224	Silver	1.2		1.2		mg/kg	1SED-3	1/3	0.37-0.6	1.2	375 N	NO	BSL
50293	4,4'-DDT	450		450		ug/kg	1SED-3	1/3	9.9-160	450	1,716 C	NO	BSL
319857	Beta-BHC	86		180		ug/kg	1SED-1	2/3	4.9	180	315 C	NO	BSL
58899	gamma-BHC (Lindane)	63		63		ug/kg	1SED-1	1/3	3.3-38	63	436 C	NO	BSL
5103742	gamma-Chlordane	300		300		ug/kg	1SED-1	1/3	12-66	300	303,147 C	NO	BSL
95761	3,4-Dichloroaniline	5,500		1,200,000		ug/kg	1SED-1	3/3	N/A	1,200,000	34,530 N	NO	BSL
106445	4-Methylphenol (p-Cresol)	39,000		39,000		ug/kg	1SED-1	1/3	4,100-94,000	39,000	7,020,072 N	NO	BSL
117817	bis(2-Ethylhexyl)phthalate	13,000		13,000		ug/kg	1SED-3	1/3	4,100-140,000	13,000	760,225 C	NO	BSL
78933	2-Butanone (MEK)	2		1800		ug/kg	1SED-1	3/3	N/A	1800	1,485,678 N	NO	BSL
591786	2-Hexanone	12		210		ug/kg	1SED-1	2/3	62	210	669 sat	NO	BSL
108101	4-Methyl-2-Pentanone (MIBK)	22		22		ug/kg	1SED-3	1/3	62-460	22	54,202 N	NO	BSL
67641	Acetone	280		1,200		ug/kg	1SED-1	2/3	12	1,200	233,948 N	NO	BSL
71432	Benzene	6		30		ug/kg	1SED-1	2/3	6	30	521,170 C	NO	BSL
108907	Chlorobenzene	66		190		ug/kg	1SED-1	2/3	6	190	54,202 N	NO	BSL
100414	Ethylbenzene	19		19		ug/kg	1SED-3	1/3	6-46	19	233,948 sat	NO	BSL
108883	Toluene	87		170		ug/kg	1SED-1	2/3	6	170	521,170 sat	NO	BSL
1330207	Xylene (total)	74		330		ug/kg	1SED-3	2/3	6	330	214,480 sat	NO	BSL

(1) Minimum/maximum detected concentration.
(2) Residential soil screening values are from USEPA Region 6 Human Health Medium-Specific Screening Levels (USEPA, 1999).
The screening value for 4-chloroaniline was used as a surrogate for 3,4-dichloroaniline.
(3) Rationale Codes Selection Reason: Above Screening Levels (ASL)

Deletion Reason: Below Screening Level (BSL)

Definitions:
N/A = Not Applicable
COPC = Chemical of Potential Concern
C = Carcinogenic
N = Non-Carcinogenic
sat = screening level based on the soil saturation equation (USEPA, 1996)
mg/kg = milligrams per kilogram

TABLE 19
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Sediment
Exposure Medium:	Sediment
Exposure Point:	Site 3

CAS Number	Chemical	Minimum [1] Concentration	Minimum Qualifier	Maximum [1] Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Screening [2] Toxicity Value		COPC Flag	Rationale for [3] Contaminant Deletion or Selection
7440382	**Arsenic**	**3.6**		**222**		**mg/kg**	**3SED-9**	**11/34**	**5**	**222**	**0.39**	**C**	**YES**	**ASL**
7440393	Barium	87.2		215		mg/kg	3SED-10	10/10	N/A	215	537	N	NO	BSL
7440473	Chromium	8		19.1		mg/kg	3SED-6	10/10	N/A	19.1	30.1	C	NO	BSL
7439921	Lead	7.4		13.9		mg/kg	3SED-2	10/10	N/A	13.9	400		NO	BSL
72548	4,4'-DDD	7.6		170		ug/kg	3SED-20-N	10/34	7-91	170	2,431	C	NO	BSL
72559	4,4'-DDE	5.1		78		ug/kg	3SED-20-S	8/34	2.7-33	78	1,716	C	NO	BSL
50293	4,4'-DDT	8		91		ug/kg	3SED-21-S	4/34	8-99	91	1,716	C	NO	BSL
309002	**Aldrin**	**2.8**		**354**		**ug/kg**	**3SED-3**	**4/34**	**2.7-33**	**354**	**28.4**	**C**	**YES**	**ASL**
60571	**Dieldrin**	**2**		**3,400**		**ug/kg**	**3SED-3**	**13/34**	**1.3-17**	**3,400**	**30.2**	**C**	**YES**	**ASL**
72208	Endrin	76		89		ug/kg	3SED-21-N	2/34	4-50	89	1,819	N	NO	BSL
53494705	Endrin ketone	19		19		ug/kg	3SED-10	1/10	20-200	19	1,819	N	NO	BSL
58899	gamma-BHC (Lindane)	18		18		ug/kg	3SED-20-N	1/34	2.7-33	18	436	C	NO	BSL
72435	Methoxychlor	130		3,600		ug/kg	3SED-1	21/34	120-460	3,600	30,315	N	NO	BSL
8001352	**Toxaphene**	**1,600**		**1,600**		**ug/kg**	**3SED-21-S**	**1/34**	**160-2,000**	**1,600**	**439**	**C**	**YES**	**ASL**
120821	1,2,4-Trichlorobenzene	92		230		ug/kg	3SED-2	2/10	380-930	230	52,144	N	NO	BSL
95501	1,2-Dichlorobenzene	120		300		ug/kg	3SED-3	2/10	380-930	300	372,612	sat	NO	BSL
91576	2-Methylnaphthalene	550		550		ug/kg	3SED-5	1/10	380-930	550	5,528	N	NO	BSL
95761	**3,4-Dichloroaniline**	**310**		**100,000**		**ug/kg**	**3SED-5**	**8/10**	**830-930**	**100,000**	**24,252**	**N**	**YES**	**ASL**
106478	4-Chloroaniline	190		500		ug/kg	3SED-3	2/10	380-930	500	24,252	N	NO	BSL
100027	4-Nitrophenol	350		350		ug/kg	3SED-1	1/10	930-4,600	350	375,903	N	NO	BSL
117840	Di-n-octylphthalate	180		180		ug/kg	3SED-8	1/10	380-930	180	121,259	N	NO	BSL
88857	Dinoseb	4,000		4,000		ug/kg	3SED-7	1/10	930-6,300	4,000	6,063	N	NO	BSL
91203	Naphthalene	86		86		ug/kg	3SED-5	1/10	380-930	86	5,528	N	NO	BSL
87865	**Pentachlorophenol**	**200**		**5,300**		**ug/kg**	**3SED-1**	**2/10**	**930-4,600**	**5,300**	**2,946**	**C**	**YES**	**ASL**
709988	Propanil	44		110		ug/kg	3SED-2	2/10	790-930	110	30,315	N	NO	BSL
107062	1,2-Dichloroethane	43		43		ug/kg	3SED-10	1/10	6-7	43	341	C	NO	BSL
67641	Acetone	130		130		ug/kg	3SED-3	1/10	11-14	130	148,568	N	NO	BSL
108907	Chlorobenzene	11		34		ug/kg	3SED-2	2/10	6-7	34	5,420	N	NO	BSL
100414	Ethylbenzene	2		7		ug/kg	3SED-5	2/10	6-7	7	233,948	sat	NO	BSL
75092	Methylene chloride	2		160		ug/kg	3SED-10	2/10	6-7	160	8,607	C	NO	BSL

TABLE 19
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Sediment
Exposure Medium:	Sediment
Exposure Point:	Site 3

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Screening (2) Toxicity Value	COPC Flag	Rationale for (3) Contaminant Deletion or Selection
1330207	Xylene (total)	12		44		ug/kg	3SED-5	2/10	6-7	44	214,480 sat	NO	BSL

(1) Minimum/maximum detected concentration.
(2) Background concentration calculated using the arithmetic mean plus two standard deviations.
(3) Residential soil screening values are from USEPA Region 6 Human Health Medium-Specific Screening Levels (USEPA, 1999).
The following screening values were used as surrogates:
-Endrin was used for endrin ketone.
4-Chloroaniline was used for 3,4-dichloroaniline.
(4) Rationale Codes Selection Reason: Above Screening Levels (ASL)
Deletion Reason: Below Screening Level (BSL)

Definitions:
N/A = Not Applicable
COPC = Chemical of Potential Concern
C = Carcinogenic
N = Non-Carcinogenic
sat = screening level based on the soil saturation equation (USEPA, 1996)
mg/kg = milligrams per kilogram
ug/kg = micrograms per kilogram

TABLE 20
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Site 1 Surface Soil

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Arsenic	mg/kg	10.1	14.4	44.6		mg/kg	14.4	UCL-T	(1)	10.1	Mean-N	(3)
Dieldrin	mg/kg	0.59	NA	0.59		mg/kg	0.59	MAX	(2)	0.59	Mean-N	(3)
1,2-Dichloroethane	mg/kg	3.8	NA	7.5		mg/kg	7.5	MAX	(2)	3.8	Mean-N	(3)

UCL = Upper Confidence Limit
EPC = Exposure Point Concentration
mg/kg = milligrams per kilogram
UCL-T = 95% UCL of Log-transformed Data
MAX = Maximum Detected Value
NA = Not Applicable

(1) The UCL was less than the maximum detected concentration; therefore, the UCL was selected as the EPC.
(2) The maximum detected concentration was selected as the EPC because the estimated UCL was greater than the maximum detected concentration.
(3) The mean concentration is the most representative value for the central tendency exposure calculation.

TABLE 21
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 2 Surface Soil

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Aldrin	mg/kg	0.0345	N/A	0.058		mg/kg	0.058	MAX	(1)	0.0345	Mean-N	(2)
Dinoseb	mg/kg	100	N/A	100		mg/kg	100	MAX	(1)	100	Mean-N	(2)

mg/kg = milligrams per kilogram
MAX = Maximum Detected Value
N/A = Not Applicable

(1) Sample population (n) is less than 10. A UCL could not be calculated.
(2) The mean concentration is the most representative value for the central tendency exposure calculation.

TABLE 22
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 4 Surface Soil

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Dieldrin	mg/kg	0.216	N/A	0.455		mg/kg	0.455	MAX	(1)	0.22	Mean-N	(3)
Dinoseb	mg/kg	170	248.4	840		mg/kg	248	UCL-T	(2)	170	Mean-N	(3)

EPC = Exposure Point Concentration
mg/kg = milligrams per kilogram
MAX = maximum Detected Concentration
UCL-T = 95% of UCL of Log-transformed Data
N/A = Not Applicable

For specific information regarding the calculation of the UCL refer to Appendix B.

(1) The data distribution was neither normal nor lognormal; therefore, the maximum concentration was selected as the EPC.
(2) The 95% UCL was less than the maximum detected concentration. The UCL was selected as the EPC.
(3) The mean concentration is the most representative value for the central tendency exposure calculation.

TABLE 23
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 6 Surface Soil

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Aldrin	mg/kg	0.043	0.017	0.24		mg/kg	0.017	UCL-T	(1)	0.04	Mean-N	(2)
Dieldrin	mg/kg	0.033	0.031	0.078		mg/kg	0.031	UCL-T	(1)	0.03	Mean-N	(2)
Methoxychlor	mg/kg	31	20.1	340		mg/kg	20.1	UCL-T	(1)	31	Mean-N	(2)
Toxaphene	mg/kg	8.25	0.78	14		mg/kg	0.78	UCL-T	(1)	8.3	Mean-N	(2)
Dinoseb	mg/kg	20.3	38	160		mg/kg	38	UCL-T	(1)	20.3	Mean-N	(2)

UCL = Upper Confidence Limit
mg/kg = milligrams per kilogram
EPC = Exposure Point Concentration
N/A = Not Applicable

(1) Because the UCL-T is less than the maximum concentration, it was selected as the EPC.
(2) The mean concentration is the most representative value for the central tendency exposure calculation.

TABLE 24
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 9 Surface Soil

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Heptachlor	mg/kg	0.15	N/A	2		mg/kg	1.5	MAX	(1)	0.15	Mean-N	(3)
3,4-Dichloroaniline	mg/kg	112	42,227,172	450		mg/kg	450	MAX	(2)	112	Mean-N	(3)
Dinoseb	mg/kg	7,593	17,181,279	29,000		mg/kg	29,000	MAX	(2)	7593	Mean-N	(3)
Propanil	mg/kg	3796	36,428,134	4,000		mg/kg	4,000	MAX	(2)	3796	Mean-N	(3)

UCL = Upper Confidence Limit
mg/kg = milligrams per kilogram
EPC = Exposure Point Concentration
MAX = Maximum Detected Value
N/A = Not Applicable

(1) The population of the data set is 2. A UCL could not be calculated.
(2) The UCL is greater than the maximum detected concentration; therefore, the maximum concentration was selected as the EPC.
(3) The mean concentration is the most representative value for the central tendency exposure calculation.

TABLE 25
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Subsurface Soil
Exposure Point:	Site 1 Subsurface Soil

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Arsenic	mg/kg	8.91	10.6	44.6		mg/kg	10.59	UCL-T	(1)	8.5	Mean	(3)
Dieldrin	mg/kg	0.593	N/A	0.593		mg/kg	0.593	MAX	(2)	0.59	Mean	(3)
1,2-Dichloroethane	mg/kg	3.758	N/A	7.5		mg/kg	7.5	MAX	(2)	2.6	Mean	(3)

UCL = Upper Confidence Limit
MAX = Maximum Detected Value
EPC = Exposure Point Concentration
mg/kg = milligrams per kilogram
UCL-T = 95% of UCL of Lognormal Data

(1) The UCL-T is less than the maximum concentration; therefore, the UCL-N was selected as the EPC.
(2) Both the lognormal and normal distributions were rejected. The maximum detected concentration was selected as the EPC.
(3) The mean concentration is the most representative value for the central tendency exposure calculation.

TABLE 26
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Subsurface Soil
Exposure Point:	Site 2 Subsurface Soil

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Arsenic	mg/kg	11.5	17.9	59.0		mg/kg	17.9	UCL-T	(1)	11.5	Mean	(3)
Chromium	mg/kg	18.6	25.2	95.3		mg/kg	25.2	UCL-T	(1)	18.6	Mean	(3)
Aldrin	mg/kg	0.103	N/A	0.42		mg/kg	0.42	MAX	(2)	0.1	Mean	(3)
Dieldrin	mg/kg	0.021	N/A	0.056		mg/kg	0.056	MAX	(2)	0.0	Mean	(3)
1,2-Dichloroethane	mg/kg	0.41	N/A	0.81		mg/kg	0.81	MAX	(2)	0.4	Mean	(3)
Chloroform	mg/kg	0.002	N/A	0.002		mg/kg	0.002	MAX	(2)	0.0	Mean	(3)
Methylene chloride	mg/kg	1.35	N/A	4		mg/kg	4	MAX	(2)	1.3	Mean	(3)

UCL = Upper Confidence Limit
MAX = Maximum Detected Value
EPC = Exposure Point Concentration
mg/kg = milligrams per kilogram
UCL-T = 95% UCL of Lognormal Data
Mean-N = Mean of Normal Data
N/A = Not applicable

(1) The UCL-T is less than the maximum concentration.
(2) The data set had less than 10 samples.
(3) The mean concentration is the most representative value for the central tendency exposure calculation.

TABLE 27
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Subsurface Soil
Exposure Point:	Site 3 Subsurface Soil

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Dinoseb	mg/kg	3,340	N/A	13,000		mg/kg	13,000	MAX	(1)	3,340	Mean	(2)

UCL = Upper Confidence Limit
EPC = Exposure Point Concentration
mg/kg = milligrams per kilogram
N/A = Not Applicable
MAX = Maximum detected value
Mean = Arithmetic Mean

(1) Data set less than 10. A UCL was not calculated.
(2) The mean concentration is the most representative value for the central tendency exposure calculation.

TABLE 28

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY

CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Subsurface Soil
Exposure Point:	Site 4 Subsurface Soil

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Arsenic	mg/kg	5.39	6.11	8.7		mg/kg	6.11	UCL-T	(1)	5.39	Mean-N	(3)
Dieldrin	mg/kg	0.27	0.037	0.63		mg/kg	0.037	UCL-T	(1)	0.27	Mean-N	(3)
3,4-Dichloroaniline	mg/kg	1667	11181616716	12000		mg/kg	12000	MAX	(2)	1667	Mean-N	(3)
Dinoseb	mg/kg	244	4199	1,100		mg/kg	1,100	MAX	(2)	244	Mean-N	(3)
1,2-Dichloroethane	mg/kg	0.09	NA	0.34		mg/kg	0.335	MAX	(2)	0.09	Mean-N	(3)

UCL = Upper Confidence Limit

MAX = Maximum Detected Value

UCL-T = 95% UCL of Log-transformed Data

(1) The 95% UCL-T was less than the maximum concentration.

(2) The 95% UCL-T was greater than the maximum concentration.

(3) The mean concentration is the most representative vallue for the central tendency exposure calculation.

TABLE 29
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Subsurface Soil
Exposure Point:	Site 9 Subsurface Soil

Chemical of Potential Concern	Units	Arithmetic Mean (1)	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Arsenic	mg/kg	5.3	N/A	7.3		mg/kg	7.3	MAX	(1)	5.3	Mean-N	(2)
3,4-Dichloroaniline	mg/kg	80	142192067	450		mg/kg	450	MAX	(1)	80	Mean-N	(2)
Dinoseb	mg/kg	5380	578,977	29000		mg/kg	29,000	MAX	(1)	5380	Mean-N	(2)
Propanil	mg/kg	445	203,639	4000		mg/kg	4,000	MAX	(1)	445	Mean-N	(2)

UCL = Upper Confidence Limit
EPC = Exposure Point Concentration
mg/kg = milligrams per kilogram
MAX = Maximum Detected Value
Mean-N = Arithmetic Mean of Normal Data

For specific information regarding the calculation of the UCL refer to Appendix B.

(1) There are 4 samples in the data set. A UCL could not be calculated.
(2) The arithmetic represents the average detected concentrations for those sample locations ≤ 10 feet below ground surface.
(3) The UCL-T is greater than the maximum detected concentration; therefore, the maximum concentration was selected as the EPC.

TABLE 30
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
CEDAR CHEMICAL, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Sediment
Exposure Medium:	Sediment
Exposure Point:	Site 1

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Arsenic	mg/kg	67.7	N/A	123		mg/kg	123	MAX	(1)	67.7	Mean-N	(2)
Chromium	mg/kg	50.2	N/A	82		mg/kg	82	MAX	(1)	50.2	Mean-N	(2)

UCL = Upper Confidence Limit
EPC = Exposure Point Concentration
mg/kg = milligrams per kilogram
N/A = Not Applicable
MAX = Maximum Detected Value
Mean-N = Arithmetic Mean of Normal Data

(1) The population of the data set is 3. The 95% UCL could not be calculated.
(2) The mean concentration is the most representative value for the central tendency exposure calculation.

TABLE 31
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
CEDAR CHEMICAL, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Sediment
Exposure Medium:	Sediment
Exposure Point:	Site 3

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Arsenic	mg/kg	27.6	8.36	222		mg/kg	8.36	UCL-T	(1)	27.6	Mean-N	(4)
Aldrin	mg/kg	0.10	0.011	0.35		mg/kg	0.011	UCL-T	(1)	0.1	Mean-N	(4)
Dieldrin	mg/kg	0.33	0.2	3.4		mg/kg	0.245	UCL-T	(1)	0.3	Mean-N	(4)
Toxaphene	mg/kg	1.6	N/A	1.6		mg/kg	1.6	MAX	(2)	1.6	Mean-N	(4)
Pentachlorophenol	mg/kg	2.8	6.2	5.3		mg/kg	5.3	MAX	(3)	2.8	Mean-N	(4)

UCL = Upper Confidence Limit
EPC = Exposure Point Concentration
mg/kg = milligrams per kilogram
UCL-T = 95th Percentile Upper Confidence Limit for Log-transformed Data
N/A = Not Applicable
MAX = Maximum Detected Value

(1) The UCL was less than the maximum concentration; therefore, the UCL was selected as the EPC.
(2) Both the lognormal and normal distributions were rejected, the maximum detected concentration was selected as the EPC.
(3) The UCL is greater than the maximum detected concentration; therefore, the maximum detected concentration was selected as the EPC.
(4) The mean concentration is the most representative value for the central tendency exposure.

TABLE 32
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater
Exposure Point:	Perched Groundwater

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Arsenic	ug/L	34	49.94	60.4		ug/L	49.94	UCL-T	(1)	34	Mean-N	(3)
Barium	ug/L	845	1362.39	2400		ug/L	1362	UCL-T	(1)	845	Mean-N	(3)
Cadmium	ug/L	7.1	8.71	16.3		ug/L	8.71	UCL-T	(1)	7.1	Mean-N	(3)
Chromium	ug/L	83	151.60	226		ug/L	152	UCL-T	(1)	83	Mean-N	(3)
Lead	ug/L	48	105.26	174		ug/L	105.26	UCL-T	(1)	48	Mean-N	(3)
4,4'-DDT	ug/L	0.154	0.34	0.56		ug/L	0.34	UCL-T	(1)	0.154	Mean-N	(3)
Alpha-BHC	ug/L	0.05	0.02	0.05		ug/L	0.02	UCL-T	(1)	0.05	Mean-N	(3)
2,6-Dinitrotoluene	ug/L	320	220.59	320		ug/L	220.59	UCL-T	(1)	320	Mean-N	(3)
3,4-Dichloroaniline	ug/L	11661	17,779,614	58,000		ug/L	58000	MAX	(2)	11,661	Mean-N	(3)
4-Chloroaniline	ug/L	686	840,454	5,900		ug/L	5900	MAX	(2)	686	Mean-N	(3)
bis(2-Chloroethyl)ether	ug/L	5	10.75	5		ug/L	5	MAX	(2)	5	Mean-N	(3)
Dinoseb	ug/L	42	107.32	42.000		ug/L	42	MAX	(2)	42	Mean-N	(3)
1,2-Dichloroethane	ug/L	3,666	280,961,146	29,000		ug/L	29000	MAX	(2)	3,666	Mean-N	(3)
4-Methyl-2-Pentanone (MIBK)	ug/L	2,200	5,672	2,200		ug/L	2200	MAX	(2)	2,200	Mean-N	(3)
Acetone	ug/L	4,800	N/A	4,800		ug/L	4800	MAX	(2)	4,800	Mean-N	(3)
Benzene	ug/L	138.7	4,215	17		ug/L	17	MAX	(2)	139	Mean-N	(3)
Chloroform	ug/L	176	3,837	700		ug/L	700	MAX	(2)	176	Mean-N	(3)
Methylene chloride	ug/L	60,015	7,457,119,902	600,000		ug/L	600000	MAX	(2)	60,015	Mean-N	(3)
Trichloroethene	ug/L	138.6	4,148	28		ug/L	28	MAX	(2)	139	Mean-N	(3)

UCL = Upper Confidence Limit
EPC = Exposure Point Concentration
μg/L = micrograms per liter
UCL-T = 95th Percentile Upper Confidence Limit for Log-transformed Data
Mean-N = Arithmetic Mean of Normal Data
MAX = Maximum Detected Value

(1) The maximum concentration is greater than the 95% UCL. The 95% UCL was selected as the EPC.
(2) The UCL was greater than the maximum detected concentration; therefore, the maximum concentration was selected as the EPC.
(3) The mean concentration is the most reporesentative value for the central tendency exposure calculation.

TABLE 33
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater
Exposure Point:	Alluvial Groundwater

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
1,1,2-Trichloroethane	µg/L	27	46	27		µg/L	27	MAX	(1)	27	Mean-N	(3)
1,2-Dichloroethane	µg/L	7,742	72,816	87,000		µg/L	72816	UCL-T	(2)	7,742	Mean-N	(3)
1,2-Dichloropropane	µg/L	43	51	43		µg/L	43	MAX	(1)	43	Mean-N	(3)
4-Methyl-2-pentanone (MIBK)	µg/L	888	864	2,500		µg/L	864.46	UCL-T	(2)	888	Mean-N	(3)
Acetone	µg/L	470	1,088	2,000		µg/L	1087.52	UCL-T	(2)	470	Mean-N	(3)
Benzene	µg/L	27	48	46		µg/L	46	MAX	(1)	27	Mean-N	(3)
Bromodichloromethane	µg/L	6	44	6		µg/L	6.1	MAX	(1)	6	Mean-N	(3)
Bromoform	µg/L	11	43	11		µg/L	11	MAX	(1)	11	Mean-N	(3)
Chlorobenzene	µg/L	135	69	470		µg/L	68.91	UCL-T	(2)	135	Mean-N	(3)
Chloroform	µg/L	478	103	1,400		µg/L	102.52	UCL-T	(2)	478	Mean-N	(3)
Dibromochloromethane	µg/L	13	45	13		µg/L	13	MAX	(1)	13	Mean-N	(3)
Methylene Chloride	µg/L	1,471	648	5,000		µg/L	647.57	UCL-T	(2)	1,471	Mean-N	(3)
Toluene	µg/L	31,379	257	140,000		µg/L	257.19	UCL-T	(2)	31,379	Mean-N	(3)

MAX = Maximum detected value
UCL = Upper confidence limit
EPC = Exposure point concentration
µg/L = micrograms per liter
N/A = Not applicable

(1) The maximum detected concentration is less than the 95% UCL; therefore, the maximum concentration was selected as the EPC.
(2) The 95% UCL is less than the maximum detected concentration; therefore, the 95% UCLwas selected as the EPC.
(3) The mean concentration is the average detected concentration.

TABLE 34
ESTIMATED AIR CONCENTRATIONS FROM IRRIGATED WATER
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Chemical	Average Detected Concentration (mg/L)	Average Inhaled Concentration (mg/m^3)	Maximum Detected Concentration (mg/L)	Maximum Inhaled Concentration (mg/m^3)	Henry's Law Constant (atm-m^3/g-mole)	Notes
1,1,2-Trichloroethane	0.027	5.70E-04	0.027	1.90E-02	9.13E-04	
1,2-Dichloroethane	8.294	2.72E-01	87	2.86E+00	1.10E-03	
1,2-Dichloropropane	0.043	3.05E-03	0.043	7.07E-02	2.82E-03	
4-Methyl-2-Pentanone (MIBK)	0.89	9.87E-03	2.5	2.78E-02	3.93E-04	a
Acetone	0.47	1.21E+00	2	5.16E+00	3.88E-05	
Benzene	0.0265	5.49E-03	0.046	2.16E-01	5.50E-03	
Bromodichloromethane	0.0061	1.70E-04	0.0061	2.79E-02	1.61E-03	a
Bromoform	0.011	5.40E-04	0.011	1.25E-02	5.00E-04	
Chlorobenzene	0.135	9.17E-03	0.47	4.77E-02	3.70E-03	
Chloroform	0.387	7.60E-04	1.4	1.44E-01	3.20E-03	
Dibromochloromethane	0.013	1.40E-04	0.013	1.40E-04	7.89E-04	a
Methylene Chloride	1.471	7.30E-02	5	4.42E+01	2.19E-03	
Toluene	31.4	4.56E+00	140	2.80E+01	6.60E-03	

Notes:

a - Converted using $H_c = H' \times R \times T$

H_c = Henry's Law Constant

H' = Henry's law (dimensionless)

R = Gas constant (8.2057 x 10-5 atm-m^3/gmole-K)

T = temperature (Kelvin scale)

TABLE 35
VALUES USED FOR DAILY INTAKE CALCULATIONS
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface and Subsurface Soil
Exposure Point: Sites 1, 2, 3, 4, 5, 6, 8, 9
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	IR-S	Ingestion Rate of Soil	mg/day	480	U.S. EPA, 1997	50[a]	USEPA, 1997	CDI ing = $\frac{(IR)(CF)(FI)(EF)(ED)}{(BW)(AT)}$
	EF	Exposure Frequency	days/year	60[b]	U.S. EPA, 1989	20[c]	Conservative Assumption	
	ED	Exposure Duration	years	1	Conservative assumption	1	Conservative Assumption	
	FI	Fraction Ingested from a contaminated source	unitless	1	Conservative assumption	1	Conservative Assumption	
	CF	Conversion Factor	kg/mg	1.00E-06	SI system	1E-06	SI system	
	BW	Body Weight	kg	70	U.S. EPA, 1989	70	USEPA, 1989	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (Noncancer)	days	365	U.S. EPA, 1989	365	USEPA, 1989	
Inhalation	InR-S	Inhalation Rate of Soil	m^3/day	20	U.S. EPA, 1989	15.2[d]	USEPA, 1997	CDI inh = $\frac{(IR)(EF)(ED)[(1/VF)+(1/PEF)]}{(BW)(AT)}$
	EF	Exposure Frequency	days/year	60b	U.S. EPA, 1989	20[c]	USEPA, 1989	
	ED	Exposure Duration	years	1	Conservative assumption	1	Conservative Assumption	
	BW	Body Weight	kg	70	U.S. EPA, 1989	70	USEPA, 1989	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (Noncancer)	days	365	U.S. EPA, 1989	365	USEPA, 1989	
	PEF	Particulate Emission Factor	m^3/kg	1.32E+09	U.S. EPA, 1996	1.32E+09	USEPA, 1989	
	VF	Volatilization Factor	m^3/kg	Chemical specific	U.S. EPA, 1998	Chemical Specific	USEPA, 1989	
Dermal	EF	Exposure Frequency	days/year	60b	U.S. EPA, 1989	20[c]	USEPA, 1989	CDI derm = $\frac{(CF)(SA)(AF)(ABSd)(EF)(ED)}{(BW)(AT)}$
	ED	Exposure Duration	years	1	Conservative assumption	1	Conservative Assumption	
	CF	Conversion Factor	kg/mg	1.00E-06	SI system	1E-06	SI system	
	SA	Skin Surface Area Available for Contact	cm^2	4100	U.S. EPA, 1997	3600[e]	USEPA, 1997	
	ABSd	Dermal Absorption Factor	unitless	Chemical specific	U.S. EPA, 1998	Chemical Specific	USEPA, 1998	
	AF	Soil-to-Skin Adherence Factor	mg/cm^2-event	1	U.S. EPA, 1995	0.0367[f]	USEPA, 1995	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (Noncancer)	days	365	U.S. EPA, 1989	365	USEPA, 1989	

RME = Reasonable Maximum Exposure
CT = Central Tendency
mg = milligram
kg = kilogram
SI system = International System of Units
m^3 = cubic meters
cm^2 = square centimeters

USEPA. 1989. Risk Assessment Guidance for Superfund - Volume I: Human Health Evaluation Manual (Part A) Interim Final. (EPA/540/1/89/002). Washington, DC. Office of Emergency and Remedial Response.
USEPA. 1997. Exposure Factors Handbook. Washington, DC. Office of Emergency and Remedial Response.
USEPA. 1996. Soil Screening Guidance: User's Guide. 2nd Edition. Washington, DC. Office of Solid Waste and Emergency Response. (Publication 9355.4-23)
USEPA. 1998. EPA Region 6 Human Health Medium-Specific Screening Levels. October.
USEPA. 1995. EPA Region 4: Supplemental Guidance to RAGS: Bulletin 3. Exposure Assessment. Atlanta, GA. Office of Health Assessment - Waste Management Division.

a - Central estimate of soil ingestion for adults.
b - Exposure frequency based on period of time the construction worker is exposed to contaminated soil during excavation activities.
c - Conservative estimate based on a 1 worker month per year frequency. Value obtained from the Department of Energy Oak Ridge Reservation, Risk Assessment Information System website at http://risk.lsd.ornl.gov/homepage/rap_tool.htm
d - Mean inhalation rate for adult males ages 16-65+ years.
e - 50th percentile skin surface area based on exposed head (1300 sq. cm), forearms (1310 sq. cm), and hands (990 sq. cm).

TABLE 36
INGESTION-SPECIFIC INTAKE FACTOR
REASONABLE MAXIMUM EXPOSURE
CONSTRUCTION WORKER EXPOSURE: INGESTION OF CHEMICALS IN SOIL AND DUST
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

EQUATION	IF oral	=	(	IR	×	EF	×	ED	×	FI	×	CF	)	÷	(	BW	×	AT	)
UNITS	kg/kg-day			mg/day		days/yr		yr		Unitless		kg/mg				kg		days	
NONCARCINOGENIC	1.13E-06	=	(	480	×	60	×	1	×	1	×	1.00E-06	)	÷	(	70	×	365	)
CARCINOGENIC	1.61E-08	=	(	480	×	60	×	1	×	1	×	1.00E-06	)	÷	(	70	×	25,550	)

See Table 35 for definitions and sources of equation variables identified as follows:

IF = intake factor
AT = averaging time
BW = body weight
FI = fraction ingested

IR = ingestion rate
EF = exposure frequency
ED = exposure duration
CF = conversion factor

TABLE 37
DERMAL-SPECIFIC INTAKE FACTOR
REASONABLE MAXIMUM EXPOSURE
CONSTRUCTION WORKER EXPOSURE: DERMAL CONTACT WITH CHEMICALS IN SOIL
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

EQUATION	IF derm	= (	SA	×	AF	×	ABS	×	EF	×	ED	×	CF	) + (	BW	×	AT	)
UNITS	kg/kg-day		cm^2/event		mg/cm^2-event		unitless		events/year		years		kg/mg		kg		days	
NONCARCINOGENIC																		
Arsenic	2.89E-07	= (	4.10E+03	×	1	×	3.00E-02	×	60	×	1	)x(	1.00E-06	) + (	70	×	365	)
Other Metals	9.63E-08	= (	4.10E+03	×	1	×	1.00E-02	×	60	×	1	)x(	1.00E-06	) + (	70	×	365	)
Dieldrin	9.63E-07	= (	4.10E+03	×	1	×	1.00E-01	×	60	×	1	)x(	1.00E-06	) + (	70	×	365	)
1,2-Dichloroethane	9.63E-07	= (	4.10E+03	×	1	×	1.00E-01	×	60	×	1	)x(	1.00E-06	) + (	70	×	365	)
Methoxychlor	9.63E-07	= (	4.10E+03	×	1	×	1.00E-01	×	60	×	1	)x(	1.00E-06	) + (	70	×	365	)
Heptachlor	9.63E-07	= (	4.10E+03	×	1	×	1.00E-01	×	60	×	1	)x(	1.00E-06	) + (	70	×	365	)
Dinoseb	9.63E-07	= (	4.10E+03	×	1	×	1.00E-01	×	60	×	1	)x(	1.00E-06	) + (	70	×	365	)
Toxaphene	9.63E-07	= (	4.10E+03	×	1	×	1.00E-01	×	60	×	1	)x(	1.00E-06	) + (	70	×	365	)
3,4-Dichloroaniline	9.63E-07	= (	4.10E+03	×	1	×	1.00E-01	×	60	×	1	)x(	1.00E-06	) + (	70	×	365	)
Propanil	9.63E-07	= (	4.10E+03	×	1	×	1.00E-01	×	60	×	1	)x(	1.00E-06	) + (	70	×	365	)
1,2-Dichloroethane	9.63E-07	= (	4.10E+03	×	1	×	1.00E-01	×	60	×	1	)x(	1.00E-06	) + (	70	×	365	)
Carbon Tetrachloride	9.63E-07	= (	4.10E+03	×	1	×	1.00E-01	×	60	×	1	)x(	1.00E-06	) + (	70	×	365	)
Chloroform	9.63E-07	= (	4.10E+03	×	1	×	1.00E-01	×	60	×	1	)x(	1.00E-06	) + (	70	×	365	)
Methylene chloride	9.63E-07	= (	4.10E+03	×	1	×	1.00E-01	×	60	×	1	)x(	1.00E-06	) + (	70	×	365	)
CARCINOGENIC																		
Arsenic	4.13E-09	= (	4.10E+03	×	1	×	3.00E-02	×	60	×	1	)x(	1.00E-06	) + (	70	×	25,550	)
Other Metals	1.38E-09	= (	4.10E+03	×	1	×	1.00E-02	×	60	×	1	)x(	1.00E-06	) + (	70	×	25,550	)
Dieldrin	1.38E-08	= (	4.10E+03	×	1	×	1.00E-01	×	60	×	1	)x(	1.00E-06	) + (	70	×	25,550	)
1,2-Dichloroethane	1.38E-08	= (	4.10E+03	×	1	×	1.00E-01	×	60	×	1	)x(	1.00E-06	) + (	70	×	25,550	)
Methoxychlor	1.38E-08	= (	4.10E+03	×	1	×	1.00E-01	×	60	×	1	)x(	1.00E-06	) + (	70	×	25,550	)
Heptachlor	1.38E-08	= (	4.10E+03	×	1	×	1.00E-01	×	60	×	1	)x(	1.00E-06	) + (	70	×	25,550	)
Dinoseb	1.38E-08	= (	4.10E+03	×	1	×	1.00E-01	×	60	×	1	)x(	1.00E-06	) + (	70	×	25,550	)
Toxaphene	1.38E-08	= (	4.10E+03	×	1	×	1.00E-01	×	60	×	1	)x(	1.00E-06	) + (	70	×	25,550	)
3,4-Dichloroaniline	1.38E-08	= (	4.10E+03	×	1	×	1.00E-01	×	60	×	1	)x(	1.00E-06	) + (	70	×	25,550	)
Propanil	1.38E-08	= (	4.10E+03	×	1	×	1.00E-01	×	60	×	1	)x(	1.00E-06	) + (	70	×	25,550	)
1,2-Dichloroethane	1.38E-08	= (	4.10E+03	×	1	×	1.00E-01	×	60	×	1	)x(	1.00E-06	) + (	70	×	25,550	)
Carbon tetrachloride	1.38E-08	= (	4.10E+03	×	1	×	1.00E-01	×	60	×	1	)x(	1.00E-06	) + (	70	×	25,550	)
Chloroform	1.38E-08	= (	4.10E+03	×	1	×	1.00E-01	×	60	×	1	)x(	1.00E-06	) + (	70	×	25,550	)
Methylene chloride	1.38E-08	= (	4.10E+03	×	1	×	1.00E-01	×	60	×	1	)x(	1.00E-06	) + (	70	×	25,550	)

See Table 35 for definitions and sources of equation variables identified as follows:

IF = intake factor
CF = conversion factor
SA = skin surface area available for contact
AF = soil to skin adherence factor

ABS = absorption factor
EF = exposure frequency
ED = exposure duration
BW = body weight
AT = averaging time

TABLE 38
REASONABLE MAXIMUM EXPOSURE
INHALATION-SPECIFIC INTAKE FACTOR
CONSTRUCTION WORKER EXPOSURE: INHALATION OF AIRBORNE CHEMICALS FROM SOIL
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

EQUATION	IFinh	= (	Inh R	×	EF	×	ED	× 1 /	PEF	+ 1 /	VF	) + (	BW	×	AT	)
UNITS	kg/kg-day		m^3/day		days/yr		yr		m^3/kg		m^3/kg		kg		days	
NONCARCINOGENIC EFFECTS																
Metals	3.56E-11	= (	20	×	60	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) + (	70	×	365	)
Aldrin	3.56E-11	= (	20	×	60	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) + (	70	×	365	)
Dieldrin	3.56E-11	= (	20	×	60	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) + (	70	×	365	)
Methoxychlor	3.56E-11	= (	20	×	60	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) + (	70	×	365	)
Heptachlor	3.56E-11	= (	20	×	60	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) + (	70	×	365	)
Dinoseb	3.56E-11	= (	20	×	60	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) + (	70	×	365	)
Toxaphene	3.56E-11	= (	20	×	60	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) + (	70	×	365	)
3,4-Dichloroaniline	3.56E-11	= (	20	×	60	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) + (	70	×	365	)
Propanil	3.56E-11	= (	20	×	60	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) + (	70	×	365	)
1,2-Dichloroethane	2.24E-05	= (	20	×	60	×	1	× 1 /	1.32E+09	+ 1 /	2.10E+03	) + (	70	×	365	)
Carbon tetrachloride	4.27E-05	= (	20	×	60	×	1	× 1 /	1.32E+09	+ 1 /	1.10E+03	) + (	70	×	365	)
Chloroform	3.35E-05	= (	20	×	60	×	1	× 1 /	1.32E+09	+ 1 /	1.40E+03	) + (	70	×	365	)
Methylene chloride	3.61E-05	= (	20	×	60	×	1	× 1 /	1.32E+09	+ 1 /	1.30E+03	) + (	70	×	365	)
CARCINOGENIC EFFECTS																
Metals	5.08E-13	= (	20	×	60	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) + (	70	×	25,550	)
Aldrin	5.08E-13	= (	20	×	60	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) + (	70	×	25,550	)
Dieldrin	5.08E-13	= (	20	×	60	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) + (	70	×	25,550	)
Methoxychlor	5.08E-13	= (	20	×	60	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) + (	70	×	25,550	)
Heptachlor	5.08E-13	= (	20	×	60	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) + (	70	×	25,550	)
Dinoseb	5.08E-13	= (	20	×	60	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) + (	70	×	25,550	)
Toxaphene	5.08E-13	= (	20	×	60	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) + (	70	×	25,550	)
3,4-Dichloroaniline	5.08E-13	= (	20	×	60	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) + (	70	×	25,550	)
Propanil	5.08E-13	= (	20	×	60	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) + (	70	×	25,550	)
1,2-Dichloroethane	3.20E-07	= (	20	×	60	×	1	× 1 /	1.32E+09	+ 1 /	2.10E+03	) + (	70	×	25,550	)
Carbon tetrachloride	6.10E-07	= (	20	×	60	×	1	× 1 /	1.32E+09	+ 1 /	1.10E+03	) + (	70	×	25,550	)
Chloroform	4.79E-07	= (	20	×	60	×	1	× 1 /	1.32E+09	+ 1 /	1.40E+03	) + (	70	×	25,550	)
Methylene chloride	5.16E-07	= (	20	×	60	×	1	× 1 /	1.32E+09	+ 1 /	1.30E+03	) + (	70	×	25,550	)

See Table 35 for definitions and sources of equation variables identified as follows:

IF = Intake factor
IR = Inhalation Rate
EF = Exposure frequency
ED = Exposure duration
ET = Exposure time

TABLE 39
VALUES USED FOR DAILY INTAKE CALCULATIONS
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Medium: Sediment
Exposure Medium: Sediment
Exposure Point: Site 1, 3
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	IR	Ingestion Rate of Sediment	mg/day	50	U.S. EPA, 1989	50	USEPA, 1997	IF = $\frac{(IR)(ET)(EF)(ED)(FI)(CF)}{(BW)(AT)}$
	EF	Exposure Frequency	days/year	60[a]	Conservative assumption	20[b]	Conservative Assumption	
	ED	Exposure Duration	years	1	Conservative assumption	1	Conservative Assumption	
	FI	Fraction Ingested from Contaminated Source	unitless	1	Conservative assumption	1	Conservative Assumption	
	CF	Conversion Factor	kg/mg	1.00E-06	SI system	1E-06	SI System	
	BW	Body Weight	kg	70	U.S. EPA, 1989	70	USEPA, 1989	
	AT - N	Averaging Time - Noncancer	days	365	U.S. EPA, 1989	365	USEPA, 1989	
	AT - C	Averaging Time - Cancer	days	25,550	U.S. EPA, 1989	25,550	USEPA, 1989	
Dermal	SA	Skin Surface Area	cm^2	4,100	U.S. EPA, 1997	3,600[c]	USEPA, 1997	IF = $\frac{(SA)(AF)(ABS)(EF)(ED)(CF)}{(BW)(AT)}$
	AF	Adherence Factor	mg/cm^2-event	1	U.S. EPA, 1995	0.0367[d]	USEPA, 1995	
	ABS	Dermal Absorption Factor	unitless	Chemical Specific	U.S. EPA, 1998	Chemical Specific	USEPA, 1998	
	EF	Exposure Frequency	days/year	60a	Conservative assumption	20[b]	Conservative Assumption	
	ED	Exposure Duration	years	1	Conservative assumption	1	Conservative Assumption	
	CF	Conversion Factor	kg/mg	1.00E-06	SI system	1E-06	SI System	
	BW	Body Weight	kg	70	U.S. EPA, 1989	70	USEPA, 1989	
	AT-N	Averaging Time - Noncancer	days	365	U.S. EPA, 1989	365	USEPA, 1989	
	AT-C	Averaging Time - Cancer	days	25,550	U.S. EPA, 1989	25,550	USEPA, 1989	

RME = Reasonable Maximum Exposure
CT = Central Tendency
mg = milligram
kg = kilogram
m^3 = cubic meters
cm^2 = square centimeters

USEPA. 1989. Risk Assessment Guidance for Superfund - Volume I: Human Health Evaluation Manual (Part A) Interim Final. (USEPA/540/1/89/002). Washington, DC. Office of Emergency and Remedial Response.
USEPA. 1997. Exposure Factors Handbook. Washington, DC. Office of Emergency and Remedial Response.
USEPA. 1998. USEPA Region 6 Human Health Medium-Specific Screening Levels. October.
USEPA. 1995. USEPA Region 4: Supplemental Guidance to RAGS: Bulletin 3. Exposure Assessment. Atlanta, GA. Office of Health Assessment - Waste Management Division.

a - Exposure frequency based on period of time the construction worker is exposed to contaminated soil during excavation activities.
b - Conservative estimate based on a 1 worker month per year frequency. Value obtained from the Department of Energy Oak Ridge Reservation, Risk Assessment Information System website at http://risk.lsd.ornl.gov/homepage/rap_tool.htm.
c - 50th percentile skin surface area based on exposed head (1300 sq. cm), forearms (1310 sq. cm) and hands (990 sq. cm).

TABLE 40
INGESTION-SPECIFIC INTAKE FACTOR

CONSTRUCTION WORKER EXPOSURE: INGESTION OF CHEMICALS IN SEDIMENT
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

EQUATION	IF ing	= (	IR	×	EF	×	ED	×	FI	×	CF	)÷(	BW	×	AT	)
UNITS	kg sediment/kg BW - day		mg/day		days/year		years		unitless		kg/mg		kg		days	
NONCARCINOGENIC	1.17E-07	= (	50	×	60	×	1	×	1	×	1.00E-06	)÷(	70	×	365	)
CARCINOGENIC	1.68E-09	= (	50	×	60	×	1	×	1	×	1.00E-06	)÷(	70	×	25,550	)

See Table 39 for definitions and sources of equation variables identified as follows:

IF = intake factor
ET = exposure time
EF = exposure frequency
ED = exposure duration
FI = fraction ingested from contaminated source

IR = ingestion rate
EF = exposure frequency
ED = exposure duratnion
CF = conversion factor

TABLE 41
DERMAL-SPECIFIC INTAKE FACTOR
REASONABLE MAXIMUM EXPOSURE
CONSTRUCTION WORKER EXPOSURE: DERMAL CONTACT WITH CHEMICALS IN SEDIMENT
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

EQUATION	IF derm	= (	SA	×	AF	×	ABS	×	EF	×	ED	×	CF	)÷(	BW	×	AT	)
UNITS	kg sediment/kg BW - day		cm^2		mg/cm^2-event		unitless		days/year		year		kg/mg		kg		days	
NONCARCINOGENIC																		
Arsenic	2.89E-07	= (	4.1E+03	×	1	×	3.0E-02	×	60	×	1	×	1.E-06	)÷(	70	×	365	)
Chromium	9.63E-08	= (	4.1E+03	×	1	×	1.0E-02	×	60	×	1	×	1.E-06	)÷(	70	×	365	)
Aldrin	9.63E-07	= (	4.1E+03	×	1	×	1.0E-01	×	60	×	1	×	1.E-06	)÷(	70	×	365	)
Dieldrin	9.63E-07	= (	4.1E+03	×	1	×	1.0E-01	×	60	×	1	×	1.E-06	)÷(	70	×	365	)
Toxaphene	9.63E-07	= (	4.1E+03	×	1	×	1.0E-01	×	60	×	1	×	1.E-06	)÷(	70	×	365	)
Pentachlorophenol	2.41E-06	= (	4.1E+03	×	1	×	2.5E-01	×	60	×	1	×	1.E-06	)÷(	70	×	365	)
CARCINOGENIC																		
Arsenic	4.13E-09	= (	4.1E+03	×	1	×	3.0E-02	×	60	×	1	×	1.E-06	)÷(	70	×	25,550	)
Chromium	1.38E-09	= (	4.1E+03	×	1	×	1.0E-02	×	60	×	1	×	1.E-06	)÷(	70	×	25,550	)
Aldrin	1.38E-08	= (	4.1E+03	×	1	×	1.0E-01	×	60	×	1	×	1.E-06	)÷(	70	×	25,550	)
Dieldrin	1.38E-08	= (	4.1E+03	×	1	×	1.0E-01	×	60	×	1	×	1.E-06	)÷(	70	×	25,550	)
Toxaphene	1.38E-08	= (	4.1E+03	×	1	×	1.0E-01	×	60	×	1	×	1.E-06	)÷(	70	×	25,550	)
Pentachlorophenol	3.44E-08	= (	4.1E+03	×	1	×	2.5E-01	×	60	×	1	×	1.E-06	)÷(	70	×	25,550	)

See Table 39 for diefinitions and sources of equation variables idenitified as follows:

IF = intake factor
CF = conversion factor
SA = skin surface area available for contact
ABS = absorption factor
EF = exposure frequency
ED = exposure duration

TABLE 42

VALUES USED FOR DAILY INTAKE CALCULATIONS

CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Perched Groundwater
Receptor Population: Construction Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	IR-W	Ingestion Rate of Water	mg/day	0.01	USEPA, 1997	0.01	USEPA, 1997	CDI ing = (IR)(CF)(FI)(EF)(ED) / (BW)(AT)
	EF	Exposure Frequency	days/year	60[b]	U.S. EPA, 1989	20[b]	Conservative Assumption	
	ED	Exposure Duration	years	1	Conservative assumption	1	Conservative Assumption	
	ET	Exposure Time	hours/day	8	USEPA, 1989	4[c]	Conservative Assumption	
	BW	Body Weight	kg	70	U.S. EPA, 1989	70	USEPA, 1989	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (Noncancer)	days	365	U.S. EPA, 1989	365	USEPA, 1989	
Dermal	SA	Skin Surface Area Available for Contact	cm^2	4,100	U.S. EPA, 1992	3,600[d]	USEPA, 1997	CDI inh = (IR)(EF)(ED)[(1/VF)+(1/PEF)] / (BW)(AT)
	EF	Exposure Frequency	days/year	60[b]	U.S. EPA, 1989	20[b]	USEPA, 1989	
	ED	Exposure Duration	years	1	Conservative assumption	1	Conservative Assumption	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (Noncancer)	days	365	U.S. EPA, 1989	365	USEPA, 1989	
	PC	Dermal Permeability Constant	cm/hr	Chemical specific	U.S. EPA, 1996	Chemical Specific	USEPA, 1989	
	ET	Exposure Time	hours/day	8	U.S. EPA, 1998	4	USEPA, 1989	
	CF	Conversion Factor	L/cm^3	1.00E-03	SI System	1.00E-03	SI System	

RME = Reasonable Maximum Exposure
CT = Central Tendency
mg = milligram
kg = kilogram
m^3 = cubic meters
cm^2 = square centimeters
IF = intake factor
SI system = International System of Units

USEPA. 1991 Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." Washington, DC. Office of Solid Waste and Emergency Response (OSWER Directive 9285.6-03).

USEPA. 1989. Risk Assessment Guidance for Superfund - Volume I: Human Health Evaluation Manual (Part A) Interim Final. (EPA/540/1/89/002). Washington, DC. Office of Emergency and Remedial Response.

USEPA. 1997. Exposure Factors Handbook. Washington, DC. Office of Emergency and Remedial Response.

USEPA. 1992. Dermal Exposure Assessment: Principles and Applications - Interim Report. Washington, DC. Office of Research and Development (EPA/600/8/-91/011B).

USEPA. 1992. Human Health Evaluation Manual, Supplemental Guidance: "Interim Dermal Risk Assessment Guidance." Draft. Office of Solid Waste and Emergency Response.

USEPA. 1999. EPA Region 6 Human Health Medium-Specific Screening Levels. October.

USEPA. 1996. Soil Screening Guidance: User's Guide. 2nd Edition. Washington, DC. Office of Solid Waste and Emergency Response. (Publication 9355.4-23).

USEPA. 1995. EPA Region 4: Supplemental Guidance to RAGS: Bulletin 3. Exposure Assessment. Atlanta, GA. Office of Health Assessment - Waste Management Division.

a - Exposure frequency based on the period of time the construction worker is exposed to contaminated perched groundwater during excavation activities.

b - Conservative estimate based on a 1 worker month per year frequency. Value obtained from the Department of Energy Oak Ridge Reservation, Risk Assesment Information System website at http://risk.lsd.ornl.gov/homepage/rap_tool.htm.

TABLE 43
INGESTION-SPECIFIC INTAKE FACTOR
CONSTRUCTION WORKER EXPOSURE: INGESTION OF CHEMICALS IN PERCHED GROUNDWATER
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

EQUATION	**IF oral**	**=**	**(**	**IR**	**×**	**ET**	**×**	**EF**	**×**	**ED**	**)**	**÷**	**(**	**BW**	**×**	**AT**	**)**
UNITS	**kg/kg-day**			**mg/hour**		**hours/day**		**days/yr**		**yr**				**kg**		**days**	
NONCARCINOGENIC	1.88E-04	=	(	0.01	×	8	×	60	×	1	)	÷	(	70	×	365	)
CARCINOGENIC	2.68E-06	=	(	0.01	×	8	×	60	×	1	)	÷	(	70	×	25,550	)

See Table 42 for definitions and sources of equation variables identified as follows:

IF = intake factor
IR = inhalation rate
ET = exposure time
EF = exposure frequency
ED = exposure duration
CF = conversion factor
BW = body weight
AT = averaging time

TABLE 44
DERMAL-SPECIFIC INTAKE FACTOR
REASONABLE MAXIMUM EXPOSURE
CONSTRUCTION WORKER EXPOSURE: DERMAL CONTACT WITH CHEMICALS IN GROUNDWATER

EQUATION	IF derm	=	(	CF	×	SA	×	PC	×	ET	×	EF	×	ED	)	+	(	BW	×	AT	)
UNITS	L/kg-day			L/cm^3		cm^2/event		cm/hr		hours/day		events/year		years				kg		days	
NONCARCINOGENIC EFFECTS																					
Arsenic	7.70E-05	=	(	1E-03	×	4100	×	1.00E-03	×	8	×	60	×	1	)	+	(	70	×	365	)
Barium	7.70E-05	=	(	1E-03	×	4100	×	1.00E-03	×	8	×	60	×	1	)	+	(	70	×	365	)
Cadmium	7.70E-05	=	(	1E-03	×	4100	×	1.00E-03	×	8	×	60	×	1	)	+	(	70	×	365	)
Chromium	7.70E-05	=	(	1E-03	×	4100	×	1.00E-03	×	8	×	60	×	1	)	+	(	70	×	365	)
4,4'-DDT	3.31E-02	=	(	1E-03	×	4100	×	4.30E-01	×	8	×	60	×	1	)	+	(	70	×	365	)
alpha-BHC	1.46E-03	=	(	1E-03	×	4100	×	1.90E-02	×	8	×	60	×	1	)	+	(	70	×	365	)
2,6-Dinitrotoluene	1.93E-04	=	(	1E-03	×	4100	×	2.50E-03	×	8	×	60	×	1	)	+	(	70	×	365	)
3,4-Dichloroaniline	2.39E-03	=	(	1E-03	×	4100	×	3.10E-02	×	8	×	60	×	1	)	+	(	70	×	365	)
4-Chloroaniline	2.39E-03	=	(	1E-03	×	4100	×	3.10E-02	×	8	×	60	×	1	)	+	(	70	×	365	)
bis(2-Chloroethyl)ether	1.62E-04	=	(	1E-03	×	4100	×	2.10E-03	×	8	×	60	×	1	)	+	(	70	×	365	)
Dinoseb	2.16E-03	=	(	1E-03	×	4100	×	2.80E-02	×	8	×	60	×	1	)	+	(	70	×	365	)
1,2-Dichloroethane	4.08E-04	=	(	1E-03	×	4100	×	5.30E-03	×	8	×	60	×	1	)	+	(	70	×	365	)
4-Methyl-2-pentanone	2.54E-04	=	(	1E-03	×	4100	×	3.30E-03	×	8	×	60	×	1	)	+	(	70	×	365	)
Acetone	4.39E-05	=	(	1E-03	×	4100	×	5.70E-04	×	8	×	60	×	1	)	+	(	70	×	365	)
Benzene	1.62E-03	=	(	1E-03	×	4100	×	2.10E-02	×	8	×	60	×	1	)	+	(	70	×	365	)
Chloroform	6.86E-04	=	(	1E-03	×	4100	×	8.90E-03	×	8	×	60	×	1	)	+	(	70	×	365	)
Methylene chloride	3.47E-04	=	(	1E-03	×	4100	×	4.50E-03	×	8	×	60	×	1	)	+	(	70	×	365	)
Trichloroethene	1.23E-03	=	(	1E-03	×	4100	×	1.60E-02	×	8	×	60	×	1	)	+	(	70	×	365	)
CARCINOGENIC EFFECTS																					
Arsenic	1.10E-06	=	(	1E-03	×	4100	×	1.00E-03	×	8	×	60	×	1	)	+	(	70	×	25,550	)
Barium	1.10E-06	=	(	1E-03	×	4100	×	1.00E-03	×	8	×	60	×	1	)	+	(	70	×	25,550	)
Cadmium	1.10E-06	=	(	1E-03	×	4100	×	1.00E-03	×	8	×	60	×	1	)	+	(	70	×	25,550	)
Chromium	1.10E-06	=	(	1E-03	×	4100	×	1.00E-03	×	8	×	60	×	1	)	+	(	70	×	25,550	)
4,4'-DDT	4.73E-04	=	(	1E-03	×	4100	×	4.30E-01	×	8	×	60	×	1	)	+	(	70	×	25,550	)
alpha-BHC	2.09E-05	=	(	1E-03	×	4100	×	1.90E-02	×	8	×	60	×	1	)	+	(	70	×	25,550	)
1,4-Dichlorobenzene	6.82E-05	=	(	1E-03	×	4100	×	6.20E-02	×	8	×	60	×	1	)	+	(	70	×	25,550	)
2,6-Dinitrotoluene	2.75E-06	=	(	1E-03	×	4100	×	2.50E-03	×	8	×	60	×	1	)	+	(	70	×	25,550	)
4-Chloroaniline	3.41E-05	=	(	1E-03	×	4100	×	3.10E-02	×	8	×	60	×	1	)	+	(	70	×	25,550	)
bis(2-Chloroethyl)ether	2.31E-06	=	(	1E-03	×	4100	×	2.10E-03	×	8	×	60	×	1	)	+	(	70	×	25,550	)
Dinoseb	3.08E-05	=	(	1E-03	×	4100	×	2.80E-02	×	8	×	60	×	1	)	+	(	70	×	25,550	)
1,2-Dichloroethane	5.83E-06	=	(	1E-03	×	4100	×	5.30E-03	×	8	×	60	×	1	)	+	(	70	×	25,550	)
4-Methyl-2-pentanone	3.63E-06	=	(	1E-03	×	4100	×	3.30E-03	×	8	×	60	×	1	)	+	(	70	×	25,550	)
Acetone	6.27E-07	=	(	1E-03	×	4100	×	5.70E-04	×	8	×	60	×	1	)	+	(	70	×	25,550	)
Benzene	2.31E-05	=	(	1E-03	×	4100	×	2.10E-02	×	8	×	60	×	1	)	+	(	70	×	25,550	)
Chloroform	9.79E-06	=	(	1E-03	×	4100	×	8.90E-03	×	8	×	60	×	1	)	+	(	70	×	25,550	)
Methylene chloride	4.95E-06	=	(	1E-03	×	4100	×	4.50E-03	×	8	×	60	×	1	)	+	(	70	×	25,550	)
Trichloroethene	1.76E-05	=	(	1E-03	×	4100	×	1.60E-02	×	8	×	60	×	1	)	+	(	70	×	25,550	)

See Table 42 for definitions and sources of equation variables identified as follows:

IF = intake factor
CF = conversion factor
SA = skin surface area available for contact
PC = permeability constant
EF = exposure frequency
ED = exposure duration
BW = body weight
AT = averaging time

TABLE 45
VALUES USED FOR DAILY INTAKE CALCULATIONS
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Sites 1, 2, 3, 5, 6, 8, 9
Receptor Population: Site Worker
Receptor Age: Adult

xposure Rout	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	IR-S	Ingestion Rate of Soil	mg/day	50	USEPA, 1989	50	USEPA, 1989	CDI ing = (IR)(CF)(FI)(EF)(ED) / (BW)(AT)
	EF	Exposure Frequency	days/year	250	USEPA, 1989	250	USEPA, 1989	
	ED	Exposure Duration	years	25	USEPA, 1989	6 6	USEPA, 1989	
	FI	source	unitless	1	Conservative assumption	0 1	Conservative Assumption	
	CF	Conversion Factor	kg/mg	1E-06	SI system	1E-06	SI System	
	BW	Body Weight	kg	70	USEPA, 1989	70	USEPA, 1989	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (Noncancer)	days	9,125	USEPA, 1989	2,409	USEPA, 1989	
Inhalation	InR-S	Inhalation Rate of Soil	m^3/day	20	USEPA, 1989	11.3	USEPA, 1997	CDI inh = (IR)(EF)(ED)[(1/VF)+(1/PEF)] / (BW)(AT)
	EF	Exposure Frequency	days/year	250	USEPA, 1989	250	USEPA, 1989	
	ED	Exposure Duration	years	25	USEPA, 1989	6.6	USEPA, 1997	
	BW	Body Weight	kg	70	USEPA, 1989	70	USEPA, 1989	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (Noncancer)	days	9,125	USEPA, 1989	2,409	USEPA, 1989	
	PEF	Particulate Emission Factor	m^3/kg	1.32E+09	USEPA, 1996	1.32E+09	USEPA, 1996	
	VF	Volatilization Factor	m^3/kg	Chemical specific	USEPA, 1998	Chemical Specific	USEPA, 1998	
Dermal	EF	Exposure Frequency	days/year	250	USEPA, 1989	250	USEPA, 1998	CDI derm = (CF)(SA)(AF)(ABSd)(EF)(ED) / (BW)(AT)
	ED	Exposure Duration	years	25	USEPA, 1989	6.6	USEPA, 1997	
	CF	Conversion Factor	kg/mg	1E-06	SI system	1E-06	SI System	
	SA	Skin Surface Area Available for Contact	cm^2	4,100	USEPA, 1997	3,600	USEPA, 1997	
	ABSd	Dermal Absorption Factor	unitless	Chemical specific	USEPA, 1998	Chemical Specific	USEPA, 1998	
	AF	Soil-to-Skin Adherence Factor	mg/cm^2-event	1	USEPA, 1995	0.0367	USEPA, 1997	
	AT-C	Averaging Time (Cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (Noncancer)	days	9,125	USEPA, 1989	2,409	USEPA, 1989	

RME = Reasonable Maximum Exposure
CT = Central Tendency
mg = milligrams
kg = kilograms
m^3 = cubic meters
cm^2 = square centimeters

USEPA. 1989. Risk Assessment Guidance for Superfund - Volume I: Human Health Evaluation Manual (Part A) Interim Final (EPA/540/1/89/002). Washington, DC. Office of Emergency and Remedial Response.
USEPA. 1997. Exposure Factors Handbook. Washington, DC. Office of Emergency and Remedial Response.
USEPA. 1996. Soil Screening Guidance: User's Guide. 2nd Edition. Washington, DC. Office of Solid Waste and Emergency Response. (Publication 9355.4-23).
USEPA. 1998. EPA Region 6 Human Health Medium-Specific Screening Levels. October.
USEPA. 1995. EPA Region 4: Supplemental Guidance to RAGS: Bulletin 3. Exposure Assessment. Atlanta, GA. Office of Health Assessment - Waste Management Division

TABLE 46
INGESTION-SPECIFIC INTAKE FACTOR
SITE WORKER EXPOSURE: INGESTION OF CHEMICALS IN SOIL
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

EQUATION	IF oral	= (	IR	×	EF	×	ED	×	FI	×	CF	) ÷ (	BW	×	AT	)
UNITS	kg/kg-day		mg/day		days/yr		yr		unitless		kg/mg		kg		days	
NONCARCINOGENIC	4.89E-07	= (	50	×	250	×	25	×	1	×	1.00E-06	) ÷ (	70	×	9,125	)
CARCINOGENIC	1.75E-07	= (	50	×	250	×	25	×	1	×	1.00E-06	) ÷ (	70	×	25,550	)

See Table 45 for definitions and sources of equation variables identified as follows:

IF = intake factor
AT = averaging time
BW = body weight
FI = fraction ingested
IR = ingestion rate
EF = exposure frequency
ED = exposure duration
CF = conversion factor

TABLE 47
DERMAL-SPECIFIC INTAKE FACTOR
SITE WORKER EXPOSURE: DERMAL CONTACT WITH CHEMICALS IN SOIL
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

EQUATION	IF derm	= (	SA	×	AF	)x(	ABS	)x(	EF	)x(	ED	)x(	CF	) + (	BW	)x(	AT	)
UNITS	kg/kg-day		cm^2/event		mg/cm^2-event		unitless		events/year		years		kg/mg		kg		days	
NONCARCINOGENIC																		
Arsenic	1.20E-06	= (	4100	×	1	×	3E-02	×	250	×	25	×	1E-06	) + (	70	×	9,125	)
Aldrin	4.01E-06	= (	4100	×	1	×	1E-01	×	250	×	25	×	1E-06	) + (	70	×	9,125	)
Dieldrin	4.01E-06	= (	4100	×	1	×	1E-01	×	250	×	25	×	1E-06	) + (	70	×	9,125	)
Heptachlor	4.01E-06	= (	4100	×	1	×	1E-01	×	250	×	25	×	1E-06	) + (	70	×	9,125	)
Methoxychlor	4.01E-06	= (	4100	×	1	×	1E-01	×	250	×	25	×	1E-06	) + (	70	×	9,125	)
3,4-Dichloroaniline	4.01E-06	= (	4100	×	1	×	1E-01	×	250	×	25	×	1E-06	) + (	70	×	9,125	)
Dinoseb	4.01E-06	= (	4100	×	1	×	1E-01	×	250	×	25	×	1E-06	) + (	70	×	9,125	)
Propanil	4.01E-06	= (	4100	×	1	×	1E-01	×	250	×	25	×	1E-06	) + (	70	×	9,125	)
Toxaphene	4.01E-06	= (	4100	×	1	×	1E-01	×	250	×	25	×	1E-06	) + (	70	×	9,125	)
1,2-Dichloroethane	4.01E-06	= (	4100	×	1	×	1E-01	×	250	×	25	×	1E-06	) + (	70	×	9,125	)
CARCINOGENIC																		
Arsenic	4.30E-07	= (	4100	×	1	×	3E-02	×	250	×	25	×	1E-06	) + (	70	×	25,550	)
Aldrin	1.43E-06	= (	4100	×	1	×	1E-01	×	250	×	25	×	1E-06	) + (	70	×	25,550	)
Dieldrin	1.43E-06	= (	4100	×	1	×	1E-01	×	250	×	25	×	1E-06	) + (	70	×	25,550	)
Heptachlor	1.43E-06	= (	4100	×	1	×	1E-01	×	250	×	25	×	1E-06	) + (	70	×	25,550	)
Methoxychlor	1.43E-06	= (	4100	×	1	×	1E-01	×	250	×	25	×	1E-06	) + (	70	×	25,550	)
3,4-Dichloroaniline	1.43E-06	= (	4100	×	1	×	1E-01	×	250	×	25	×	1E-06	) + (	70	×	25,550	)
Dinoseb	1.43E-06	= (	4100	×	1	×	1E-01	×	250	×	25	×	1E-06	) + (	70	×	25,550	)
Propanil	1.43E-06	= (	4100	×	1	×	1E-01	×	250	×	25	×	1E-06	) + (	70	×	25,550	)
Toxaphene	1.43E-06	= (	4100	×	1	×	1E-01	×	250	×	25	×	1E-06	) + (	70	×	25,550	)
1,2-Dichloroethane	1.43E-06	= (	4100	×	1	×	1E-01	×	250	×	25	×	1E-06	) + (	70	×	25,550	)

See Table 45 for definitions and sources of equation variables identified as follows:

IF = intake factor
CF = conversion factor
SA = skin surface area available for contact
AF = soil to skin adherence factor
ABS = absorption factor
EF = exposure frequency
ED = exposure duration
BW = body weight
AT = averaging time

TABLE 48
INHALATION-SPECIFIC INTAKE FACTOR
SITE WORKER EXPOSURE: INHALATION OF AIRBORNE CHEMICALS FROM SOIL
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

EQUATION	IFinh	=	(	IR	×	EF	×	ED	×	1	/	PEF	+	1	/	VF	)	+	(	BW	×	AT	)
UNITS	kg/kg-day			m^3/day		days/yr		yr				m^3/kg				m^3/kg				kg		days	
NONCARCINOGENIC EFFECTS																							
Arsenic	1.48E-10	=	(	20	×	250	×	25	×	1	/	1.32E+09	+	1	/	N/A	)	+	(	70	×	9,125	)
Aldrin	1.48E-10	=	(	20	×	250	×	25	×	1	/	1.32E+09	+	1	/	N/A	)	+	(	70	×	9,125	)
Dieldrin	1.48E-10	=	(	20	×	250	×	25	×	1	/	1.32E+09	+	1	/	N/A	)	+	(	70	×	9,125	)
Heptachlor	1.48E-10	=	(	20	×	250	×	25	×	1	/	1.32E+09	+	1	/	N/A	)	+	(	70	×	9,125	)
Methoxychlor	1.48E-10	=	(	20	×	250	×	25	×	1	/	1.32E+09	+	1	/	N/A	)	+	(	70	×	9,125	)
3,4-Dichloroaniline	1.48E-10	=	(	20	×	250	×	25	×	1	/	1.32E+09	+	1	/	N/A	)	+	(	70	×	9,125	)
Dinoseb	1.48E-10	=	(	20	×	250	×	25	×	1	/	1.32E+09	+	1	/	N/A	)	+	(	70	×	9,125	)
Propanil	1.48E-10	=	(	20	×	250	×	25	×	1	/	1.32E+09	+	1	/	N/A	)	+	(	70	×	9,125	)
Toxaphene	1.48E-10	=	(	20	×	250	×	25	×	1	/	1.32E+09	+	1	/	N/A	)	+	(	70	×	9,125	)
1,2-Dichloroethane	9.32E-05	=	(	20	×	250	×	25	×	1	/	1.32E+09	+	1	/	2.10E+03	)	+	(	70	×	9,125	)
CARCINOGENIC EFFECTS																							
Arsenic	5.29E-11	=	(	20	×	250	×	25	×	1	/	1.32E+09	+	1	/	N/A	)	+	(	70	×	25,550	)
Aldrin	5.29E-11	=	(	20	×	250	×	25	×	1	/	1.32E+09	+	1	/	N/A	)	+	(	70	×	25,550	)
Dieldrin	5.29E-11	=	(	20	×	250	×	25	×	1	/	1.32E+09	+	1	/	N/A	)	+	(	70	×	25,550	)
Heptachlor	5.29E-11	=	(	20	×	250	×	25	×	1	/	1.32E+09	+	1	/	N/A	)	+	(	70	×	25,550	)
Methoxychlor	5.29E-11	=	(	20	×	250	×	25	×	1	/	1.32E+09	+	1	/	N/A	)	+	(	70	×	25,550	)
3,4-Dichloroaniline	5.29E-11	=	(	20	×	250	×	25	×	1	/	1.32E+09	+	1	/	N/A	)	+	(	70	×	25,550	)
Dinoseb	5.29E-11	=	(	20	×	250	×	25	×	1	/	1.32E+09	+	1	/	N/A	)	+	(	70	×	25,550	)
Propanil	5.29E-11	=	(	20	×	250	×	25	×	1	/	1.32E+09	+	1	/	N/A	)	+	(	70	×	25,550	)
Toxaphene	5.29E-11	=	(	20	×	250	×	25	×	1	/	1.32E+09	+	1	/	N/A	)	+	(	70	×	25,550	)
1,2-Dichloroethane	3.33E-05	=	(	20	×	250	×	25	×	1	/	1.32E+09	+	1	/	2.10E+03	)	+	(	70	×	25,550	)

See Table 45 for definitions and sources of equation variables identified as follows:
IF = Intake factor
IR = Inhalation Rate
EF = Exposure frequency
ED = Exposure duration
ET = Exposure time
PEF = Particulate emission factor
VF = Volatilization factor
BW = Body weight
AT = Averaging time

TABLE 49
VALUES USED FOR DAILY INTAKE CALCULATIONS
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Sites 1, 2, 3, 4, 5, 6, 8, 9
Receptor Population: Trespasser
Receptor Age: Adolescent

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	IR-S	Ingestion Rate of Soil	mg/day	50	U.S. EPA, 1989	50	U.S. EPA, 1989	CDI ing = (IR)(CF)(FI)(EF)(ED) / (BW)(AT)
	EF	Exposure Frequency	days/year	52	Conservative assumption	26	Conservative assumption	
	ED	Exposure Duration	years	10	Conservative assumption	10	Conservative assumption	
	FI	Fraction ingested from contaminated source	unitless	1	Conservative assumption	0.1	Conservative assumption	
	CF	Conversion Factor	kg/mg	1E-06	SI system	1.00E-06	SI system	
	BW	Body Weight	kg	45	U.S. EPA, 1989	45	U.S. EPA, 1989	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, 1989	25,550	U.S. EPA, 1989	
	AT-N	Averaging Time (Noncancer)	days	3,650	U.S. EPA, 1989	3,650	U.S. EPA, 1989	
Inhalation	InR-S	Inhalation Rate of Soil	m^3/day	20	U.S. EPA, 1989	11.3	U.S. EPA, 1989	CDI inh = (IR)(EF)(ED)[(1/VF)+(1/PEF)] / (BW)(AT)
	EF	Exposure Frequency	days/year	52	Conservative assumption	26	Conservative assumption	
	ED	Exposure Duration	years	10	Conservative assumption	10	Conservative assumption	
	BW	Body Weight	kg	45	U.S. EPA, 1989	45	U.S. EPA, 1989	
	AT-C	Averaging Time (Cancer)	days	25550	U.S. EPA, 1989	25,550	U.S. EPA, 1989	
	AT-N	Averaging Time (Noncancer)	days	3650	U.S. EPA, 1989	3,650	U.S. EPA, 1989	
	PEF	Particulate Emission Factor	m^3/kg	1.32E+09	U.S. EPA, 1996	1.32E+09	U.S. EPA, 1996	
	VF	Volatilization Factor	m^3/kg	Chemical specific	U.S. EPA, 1998	Chemical Specific	U.S. EPA, 1998	
Dermal	EF	Exposure Frequency	days/year	52	Conservative assumption	26	Conservative assumption	CDI derm = (CF)(SA)(AF)(ABSd)(EF)(ED) / (BW)(AT)
	ED	Exposure Duration	years	10	Conservative assumption	10	Conservative assumption	
	CF	Conversion Factor	kg/mg	1E-06	SI system	1.00E-06	SI system	
	SA	Skin Surface Area Available for Contact	cm^2	4100	U.S. EPA, 1997	3,600	U.S. EPA, 1997	
	ABSd	Dermal Absorption Factor	unitless	Chemical specific	U.S. EPA, 1998	Chemical Specific	U.S. EPA, 1998	
	AF	Soil-to-Skin Adherence Factor	mg/cm^2-event	1	U.S. EPA, 1995	0.0367	U.S. EPA, 1995	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, 1989	25,550	U.S. EPA, 1989	
	AT-N	Averaging Time (Noncancer)	days	3,650	U.S. EPA, 1989	3,650	U.S. EPA, 1989	

RME = Reasonable Maximum Exposure
CT = Central Tendency
mg = milligrams
kg = kilograms
m^3 = cubic meters
cm^2 = square centimeters

USEPA. 1989. Risk Assessment Guidance for Superfund - Volume I: Human Health Evaluation Manual (Part A) Interim Final. (U.S. EPA/540/1/89/002). Washington, DC. Office of Emergency and Remedial Response.
USEPA. 1997. Exposure Factors Handbook. Washington, DC. Office of Emergency and Remedial Response.
USEPA. 1996. Soil Screening Guidance: User's Guide. 2nd Edition. Washington, DC. Office of Solid Waste and Emergency Response. (Publication 9355.4-23).
USEPA. 1998. U.S. EPA Region 6 Human Health Medium-Specific Screening Levels. October.
USEPA. 1995. U.S. EPA Region 4: Supplemental Guidance to RAGS: Bulletin 3. Exposure Assessment. Atlanta, GA. Office of Health Assessment - Waste Management Division

TABLE 50
INGESTION-SPECIFIC INTAKE FACTOR
TRESPASSER/VISITOR EXPOSURE: INGESTION OF CHEMICALS IN SOIL AND DUST
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

EQUATION	IF oral	=	(	IR	×	EF	×	ED	×	FI	×	CF	)	÷	(	BW	×	AT	)
UNITS	kg/kg-day			mg/day		days/yr		yr		Unitless		kg/mg				kg		days	
NONCARCINOGENIC	1.58E-07	=	(	50	×	52	×	10	×	1	×	1.00E-06	)	÷	(	45	×	3,650	)
CARCINOGENIC	2.26E-08	=	(	50	×	52	×	10	×	1	×	1.00E-06	)	÷	(	45	×	25,550	)

See Table 49 for definitions and sources of equation variables identified as follows:

IF = intake factor
AT = averaging time
BW = body weight
FI = fraction ingested
IR = ingestion rate
EF = exposure frequency
ED = exposure duration
CF = conversion factor

TABLE 51
DERMAL-SPECIFIC INTAKE FACTOR
TRESPASSER/VISITOR EXPOSURE: DERMAL CONTACT WITH CHEMICALS IN SOIL
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

EQUATION	IF derm	= (	SA	×	AF	×	ABS	×	EF	×	ED	×	CF	) + (	BW	×	AT	)
UNITS	kg/kg-day		cm^2		mg/cm^2-event		unitless		events/year		years		kg/mg		kg		days	
NONCARCINOGENIC																		
Arsenic	3.89E-07	= (	4100	×	1.0	×	3.00E-02	×	52	×	10	×	1.00E-06	) + (	45	×	3,650	)
Aldrin	1.30E-06	= (	4100	×	1.0	×	1.00E-01	×	52	×	10	×	1.00E-06	) + (	45	×	3,650	)
Dieldrin	1.30E-06	= (	4100	×	1.0	×	1.00E-01	×	52	×	10	×	1.00E-06	) + (	45	×	3,650	)
Heptachlor	1.30E-06	= (	4100	×	1.0	×	1.00E-01	×	52	×	10	×	1.00E-06	) + (	45	×	3,650	)
Methoxychlor	1.30E-06	= (	4100	×	1.0	×	1.00E-01	×	52	×	10	×	1.00E-06	) + (	45	×	3,650	)
3,4-Dichloroaniline	1.30E-06	= (	4100	×	1.0	×	1.00E-01	×	52	×	10	×	1.00E-06	) + (	45	×	3,650	)
Dinoseb	1.30E-06	= (	4100	×	1.0	×	1.00E-01	×	52	×	10	×	1.00E-06	) + (	45	×	3,650	)
Propanil	1.30E-06	= (	4100	×	1.0	×	1.00E-01	×	52	×	10	×	1.00E-06	) + (	45	×	3,650	)
Toxaphene	1.30E-06	= (	4100	×	1.0	×	1.00E-01	×	52	×	10	×	1.00E-06	) + (	45	×	3,650	)
1,2-Dichloroethane	1.30E-06	= (	4100	×	1.0	×	1.00E-01	×	52	×	10	×	1.00E-06	) + (	45	×	3,650	)
CARCINOGENIC																		
Arsenic	5.56E-08	= (	4100	×	1.0	×	3.00E-02	×	52	×	10	×	1.00E-06	) + (	45	×	25,550	)
Aldrin	1.85E-07	= (	4100	×	1.0	×	1.00E-01	×	52	×	10	×	1.00E-06	) + (	45	×	25,550	)
Dieldrin	1.85E-07	= (	4100	×	1.0	×	1.00E-01	×	52	×	10	×	1.00E-06	) + (	45	×	25,550	)
Heptachlor	1.85E-07	= (	4100	×	1.0	×	1.00E-01	×	52	×	10	×	1.00E-06	) + (	45	×	25,550	)
Methoxychlor	1.85E-07	= (	4100	×	1.0	×	1.00E-01	×	52	×	10	×	1.00E-06	) + (	45	×	25,550	)
3,4-Dichloroaniline	1.85E-07	= (	4100	×	1.0	×	1.00E-01	×	52	×	10	×	1.00E-06	) + (	45	×	25,550	)
Dinoseb	1.85E-07	= (	4100	×	1.0	×	1.00E-01	×	52	×	10	×	1.00E-06	) + (	45	×	25,550	)
Propanil	1.85E-07	= (	4100	×	1.0	×	1.00E-01	×	52	×	10	×	1.00E-06	) + (	45	×	25,550	)
Toxaphene	1.85E-07	= (	4100	×	1.0	×	1.00E-01	×	52	×	10	×	1.00E-06	) + (	45	×	25,550	)
1,2-Dichloroethane	1.85E-07	= (	4100	×	1.0	×	1.00E-01	×	52	×	10	×	1.00E-06	) + (	45	×	25,550	)

See Table 49 for definitions and sources of equation variables identified as follows:
IF = intake factor
CF = conversion factor
SA = skin surface area available for contact
AF = soil to skin adherence factor
ABS = absorption factor
EF = exposure frequency
ED = exposure duration
BW = body weight
AT = averaging time

TABLE 52
INHALATION-SPECIFIC INTAKE FACTOR
TRESPASSER/VISITOR EXPOSURE: INHALATION OF AIRBORNE CHEMICALS FROM SOIL
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

EQUATION	IFinh	= (	Inh R	×	EF	×	ED	× 1 /	PEF	+ 1 /	VF	) + (	BW	×	AT	)
UNITS	kg/kg-day		m^3/day		days/yr		yr		m^3/kg		m^3/kg		kg		days	
NONCARCINOGENIC EFFECTS																
Arsenic	4.80E-11	= (	20	×	52	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) + (	45	×	3,650	)
Aldrin	4.80E-11	= (	20	×	52	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) + (	45	×	3,650	)
Dieldrin	4.80E-11	= (	20	×	52	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) + (	45	×	3,650	)
Heptachlor	4.80E-11	= (	20	×	52	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) + (	45	×	3,650	)
Methoxychlor	4.80E-11	= (	20	×	52	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) + (	45	×	3,650	)
3,4-Dichloroaniline	4.80E-11	= (	20	×	52	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) + (	45	×	3,650	)
Dinoseb	4.80E-11	= (	20	×	52	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) + (	45	×	3,650	)
Propanil	4.80E-11	= (	20	×	52	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) + (	45	×	3,650	)
Toxaphene	4.80E-11	= (	20	×	52	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) + (	45	×	3,650	)
1,2-Dichloroethane	3.02E-05	= (	20	×	52	×	10	× 1 /	1.32E+09	+ 1 /	2.10E+03	) + (	45	×	3,650	)
CARCINOGENIC EFFECTS																
Arsenic	6.85E-12	= (	20	×	52	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) + (	45	×	25,550	)
Aldrin	6.85E-12	= (	20	×	52	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) + (	45	×	25,550	)
Dieldrin	6.85E-12	= (	20	×	52	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) + (	45	×	25,550	)
Heptachlor	6.85E-12	= (	20	×	52	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) + (	45	×	25,550	)
Methoxychlor	6.85E-12	= (	20	×	52	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) + (	45	×	25,550	)
3,4-Dichloroaniline	6.85E-12	= (	20	×	52	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) + (	45	×	25,550	)
Dinoseb	6.85E-12	= (	20	×	52	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) + (	45	×	25,550	)
Propanil	6.85E-12	= (	20	×	52	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) + (	45	×	25,550	)
Toxaphene	6.85E-12	= (	20	×	52	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) + (	45	×	25,550	)
1,2-Dichloroethane	4.31E-06	= (	20	×	52	×	10	× 1 /	1.32E+09	+ 1 /	2.10E+03	) + (	45	×	25,550	)

See Table 49 for definitions and sources of equation variables identified as follows:

IF = Intake factor
IR = Inhalation Rate
EF = Exposure frequency
ED = Exposure duration
ET = Exposure time
PEF = Particulate Emission Factor
VF= Volatilization Factor

TABLE 53
VALUES USED FOR DAILY INTAKE CALCULATIONS
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Medium: Sediment
Exposure Medium: Sediment
Exposure Point: Site 1, 3
Receptor Population: Trespasser
Receptor Age: Adolescent

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	IR	Ingestion Rate of Sediment	mg/day	50	U.S. EPA, 1989	50	U.S. EPA, 1989	IF = (IR)(ET)(EF)(ED)(FI)(CF) / (BW)(AT)
	ET	Exposure Time	hours/day	2	Conservative assumption	2	Conservative assumption	
	EF	Exposure Frequency	days/year	52	Conservative assumption	26	Conservative assumption	
	ED	Exposure Duration	years	10	Conservative assumption	10	Conservative assumption	
	FI	Fraction Ingested from Contaminated Source	unitless	1	Conservative assumption	0.1	Conservative assumption	
	CF	Conversion Factor	kg/mg	1E-06	SI system	1.00E-06	SI system	
	BW	Body Weight	kg	45	U.S. EPA, 1989	45	U.S. EPA, 1989	
	AT - N	Averaging Time - Noncancer	days	3,650	U.S. EPA, 1989	3650	U.S. EPA, 1989	
	AT - C	Averaging Time - Cancer	days	25,550	U.S. EPA, 1989	25550	U.S. EPA, 1989	
Dermal	SA	Skin Surface Area	cm^2	4,100	U.S. EPA, 1997	3,600	--	IF = (SA)(AF)(ABS)(EF)(ED)(CF) / (BW)(AT)
	AF	Adherence Factor	mg/cm^2-event	1	U.S. EPA, 1995	0.0367	--	
	ABS	Dermal Absorption Factor	unitless	Chemical Specific	U.S. EPA, 1998	Chemical Specific	--	
	EF	Exposure Frequency	days/year	52	Conservative assumption	26	--	
	ED	Exposure Duration	years	10	Conservative assumption	10	--	
	CF	Conversion Factor	kg/mg	1E-06	SI System	1.00E-06	--	
	BW	Body Weight	kg	45	U.S. EPA, 1989	45	--	
	AT-N	Averaging Time - Noncancer	days	3,650	U.S. EPA, 1989	3650	--	
	AT-C	Averaging Time - Cancer	days	25,550	U.S. EPA, 1989	25550	--	

RME = Reasonable Maximum Exposure
CT = Central Tendency
mg = milligrams
kg = kilograms
m^3 = cubic meters
cm^2 = square centimeters

USEPA. 1989. Risk Assessment Guidance for Superfund - Volume I: Human Health Evaluation Manual (Part A) Interim Final. (USEPA/540/1/89/002). Washington, DC. Office of Emergency and Remedial Response
USEPA. 1997. Exposure Factors Handbook. Washington, DC. Office of Emergency and Remedial Response.
USEPA. 1998. USEPA Region 6 Human Health Medium-Specific Screening Levels. October.
USEPA. 1995. USEPA Region 4: Supplemental Guidance to RAGS: Bulletin 3. Exposure Assessment. Atlanta, GA. Office of Health Assessment - Waste Management Division.

TABLE 54
INGESTION-SPECIFIC INTAKE FACTOR
TRESPASSER EXPOSURE: INGESTION OF CHEMICALS IN SEDIMENT
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

EQUATION	IF ing	= (	IR	×	ET	×	EF	×	ED	×	FI	×	CF	)÷(	BW	×	AT	)
UNITS	kg sediment/kg BW - day		mg/day		hours/day		days/year		years		unitless		kg/mg		kg		days	
NONCARCINOGENIC	3.17E-07	= (	50	×	2	×	52	×	10	×	1	×	1E-06	)÷(	45	×	3,650	)
CARCINOGENIC	4.52E-08	= (	50	×	2	×	52	×	10	×	1	×	1E-06	)÷(	45	×	25,550	)

See Table 53 for definitions and sources of equation variables identified as follows:

IF = intake factor
ET = exposure time
EF = exposure frequency
ED = exposure duration
FI = fraction ingested from contaminated source

IR = ingestion rate
EF = exposure frequency
ED = exposure duratnion
CF = conversion factor

TABLE 55
DERMAL-SPECIFIC INTAKE FACTOR
TRESPASSER EXPOSURE: DERMAL CONTACT WITH CHEMICALS IN SEDIMENT
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

EQUATION	IF derm	= (	SA	×	AF	×	ABS	×	EF	×	ED	×	CF	)÷(	BW	×	AT	)
UNITS	kg sediment/kg BW - day		cm^2		mg/cm^2-event		unitless		days/year		year		kg/mg		kg		days	
NONCARCINOGENIC																		
Arsenic	3.89E-07	= (	4.1E+03	×	1	×	3.0E-02	×	52	×	10	×	1.E-06	)÷(	45	×	3,650	)
Chromium	1.30E-07	= (	4.1E+03	×	1	×	1.0E-02	×	52	×	10	×	1.E-06	)÷(	45	×	3,650	)
Aldrin	1.30E-06	= (	4.1E+03	×	1	×	1.0E-01	×	52	×	10	×	1.E-06	)÷(	45	×	3,650	)
Dieldrin	1.30E-06	= (	4.1E+03	×	1	×	1.0E-01	×	52	×	10	×	1.E-06	)÷(	45	×	3,650	)
Toxaphene	1.30E-06	= (	4.1E+03	×	1	×	1.0E-01	×	52	×	10	×	1.E-06	)÷(	45	×	3,650	)
Pentachlorophenol	3.25E-06	= (	4.1E+03	×	1	×	2.5E-01	×	52	×	10	×	1.E-06	)÷(	45	×	3,650	)
CARCINOGENIC																		
Arsenic	5.56E-08	= (	4.1E+03	×	1	×	3.0E-02	×	52	×	10	×	1.E-06	)÷(	45	×	25,550	)
Chromium	1.85E-08	= (	4.1E+03	×	1	×	1.0E-02	×	52	×	10	×	1.E-06	)÷(	45	×	25,550	)
Aldrin	1.85E-07	= (	4.1E+03	×	1	×	1.0E-01	×	52	×	10	×	1.E-06	)÷(	45	×	25,550	)
Dieldrin	1.85E-07	= (	4.1E+03	×	1	×	1.0E-01	×	52	×	10	×	1.E-06	)÷(	45	×	25,550	)
Toxaphene	1.85E-07	= (	4.1E+03	×	1	×	1.0E-01	×	52	×	10	×	1.E-06	)÷(	45	×	25,550	)
Pentachlorophenol	4.64E-07	= (	4.1E+03	×	1	×	2.5E-01	×	52	×	10	×	1.E-06	)÷(	45	×	25,550	)

See Table 53 for diefinitions and sources of equation variables idenitified as follows:

IF = intake factor
CF = conversion factor
SA = skin surface area available for contact
ABS = absorption factor
EF = exposure frequency
ED = exposure duration

TABLE 56
VALUES USED FOR DAILY INTAKE CALCULATIONS
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Alluvial Groundwater
Receptor Population: Offsite Agricultural Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	USEPA, RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation[a]	IR-A	Inhalation Rate of Air	m^3/hr	0.83	USEPA, 1991	0.83	USEPA, 1991	IF inh = (IR)(EF)(ED) / (BW)(AT)
	EF	Exposure Frequency	days/year	44.6	CES, 1999	44.6	CES, 1999	
	ED	Exposure Duration	years	25	USEPA, 1989	25	USEPA, 1989	
	ET	Exposure Time	hours/day	4	Conservative Assumption	2	Conservative Assumption	
	BW	Body Weight	kg	70	USEPA, 1989	70	USEPA, 1989	
	AT-C	Averaging Time (Cancer)	days	25550	USEPA, 1989	25550	USEPA, 1989	
	AT-N	Averaging Time (Noncancer)	days	9125	USEPA, 1989	9125	USEPA, 1989	

RME = Reasonable Maximum Exposure
CT = Central Tendency
mg = milligrams
kg = kilograms
m^3 = cubic meters
cm^2 = square centimeters
IF = intake factor

a = Inhalation of Groundwater While Showering intake factor calculated in accordance with Technical Memorandum Guidance on Estimating Exposure to VOCs During Showering, (USEPA, 1991).

USEPA. 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." Washington, DC. Office of Solid Waste and Emergency Response. (OSWER Directive 9285.6-03).
CES, 1999. Phone communication with Jerry Williams of the Phillips County Cooperative Extension Service, July, 1999.
USEPA. 1989. Risk Assessment Guidance for Superfund - Volume I: Human Health Evaluation Manual (Part A) Interim Final. (EPA/540/1/89/002). Washington, DC. Office of Emergency and Remedial Response.
USEPA. 1997. Exposure Factors Handbook. Washington, DC. Office of Emergency and Remedial Response. (EPA/600/8-89/043).
USEPA. 1992. Dermal Exposure Assessment: Principles and Applications-Interim Report. Washington, DC. Office of Research and Development. (EPA/600/8-91/011B).
USEPA. 1998. EPA Region 6 Human Health Medium-Specific Screening Levels. October.
USEPA. 1996. Soil Screening Guidance: User's Guide. 2nd Edition. Washington, DC. Office of Solid Waste and Emergency Response. (Publication 9355.4-23).
USEPA. 1995. EPA Region 4: Supplemental Guidance to RAGS: Bulletin 3. Exposure Assessment. Atlanta, GA. Office of Health Assessment - Waste Management Division.

TABLE 57
INHALATION-SPECIFIC INTAKE FACTOR
OFFSITE AGRICULTURAL WORKER EXPOSURE: INHALATION OF AIRBORNE (VAPOR PHASE) CHEMICALS FROM GROUNDWATER
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

EQUATION	IFinh	=	(	IR	×	EF	×	ED	×	ET	)	÷	(	BW	×	AT	)
UNITS	m^3/kg-day			m^3/hour		days/yr		yr		hr/day				kg		days	
NONCARCINOGENIC EFFECTS	5.80E-03	=	(	0.83	×	44.6	×	25	×	4	)	÷	(	70	×	9,125	)
CARCINOGENIC EFFECTS	2.07E-03	=	(	0.83	×	44.6	×	25	×	4	)	÷	(	70	×	25,550	)

See Table 56 for definitions and sources of equation variables identified as follows:

IF = Intake factor

IR = Inhalation Rate

EF = Exposure frequency

ED = Exposure duration

ET = Exposure time

TABLE 58
NON-CANCER TOXICITY DATA -- ORAL/DERMAL
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Oral to Dermal Adjustment Factor	Adjusted Dermal RfD	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: Target Organ (3)
Arsenic	Chronic	3.0E-04	mg/kg-day	1	3.0E-04	mg/kg-day	Skin	3/1	IRIS	06/01/95
Arsenic	Subchronic	3.0E-04	mg/kg-day	1	3.0E-04	mg/kg-day	Skin	3	HEAST	07/01/97
Chromium VI	Chronic	3.0E-03	mg/kg-day	0.2	6.0E-04	mg/kg-day	NOAEL	300/3	IRIS	09/03/98
Mercury	Chronic	ND	ND	ND	N/A	ND	ND	ND	IRIS	06/01/95
Chromium	Chronic	1.5E+00	mg/kg-day	0.2	3.0E-01	mg/kg-day	NOEL	1000/10	IRIS	09/03/98
Dieldrin	Subchronic	5.0E-05	mg/kg-day	0.5	2.5E-05	mg/kg-day	Liver	100/1	HEAST	07/01/97
Dieldrin	Chronic	5.0E-05	mg/kg-day	0.5	2.5E-05	mg/kg-day	Liver	100/1	HEAST	07/01/97
Aldrin	Chronic	3.0E-05	mg/kg-day	0.5	1.5E-05	mg/kg-day	Liver	1000/1	IRIS	01/01/91
Aldrin	Subchronic	3.00E-05	mg/kg-day	0.5	1.5E-05	mg/kg-day	Liver	1000/1	HEAST	07/01/97
Methoxychlor	Chronic	5.0E-03	mg/kg-day	0.5	2.5E-03	mg/kg-day	Reproduction	1000/1	IRIS	04/01/92
Methoxychlor	Subchronic	5.0E-03	mg/kg-day	0.5	2.5E-03	mg/kg-day	Reproduction	1000/1	HEAST	07/01/97
Toxaphene	ND	ND	ND	ND	ND	ND	ND	ND	IRIS	01/01/91
Heptachlor	Chronic	5.0E-04	mg/kg-day	0.5	2.5E-04	mg/kg-day	Liver	300/1	IRIS	01/01/91
Heptachlor	Subchronic	5.0E-04	mg/kg-day	0.5	2.5E-04	mg/kg-day	Liver	300/1	HEAST	07/01/97
Dibromochloromethane	Chronic	2.0E-02	mg/kg-day	0.8	1.6E-02	mg/kg-day	Liver	1000/1	IRIS	11/01/90
1,2-Dichloroethane	Chronic	3.0E-02	mg/kg-day	0.8	2.4E-02	mg/kg-day	ND	ND	Region 6	05/01/99
1,2-Dichloroethane	Subchronic	ND	ND	ND	ND	ND	ND	ND	HEAST	07/01/97
Carbon tetrachloride	Chronic	7.0E-04	mg/kg-day	0.8	5.6E-04	mg/kg-day	Liver	1000/1	IRIS	01/01/91
Chloroform	Subchronic	1.0E-02	mg/kg-day	0.8	8.0E-03	mg/kg-day	Liver	300	HEAST	07/01/97
Chloroform	Chronic	1.00E-02	mg/kg-day	0.8	8.0E-03	mg/kg-day	Liver	1000/1	IRIS	01/01/91
Methylene chloride	Subchronic	6.0E-02	mg/kg-day	0.8	4.8E-02	mg/kg-day	Liver	100/1	HEAST	07/01/97
Methylene chloride	Chronic	6.0E-02	mg/kg-day	0.8	4.8E-02	mg/kg-day	Liver	100/1	IRIS	01/01/91
Dinoseb	Chronic	1.0E-03	mg/kg-day	0.5	5.0E-04	mg/kg-day	Whole body	100/1	IRIS	10/01/89
Dinoseb	Subchronic	1E-03	mg/kg-day	0.5	5.0E-04	mg/kg-day	Whole body	1000/1	HEAST	07/01/97
3,4-Dichloroaniline (4)	Chronic	4.0E-03	mg/kg-day	0.5	2.0E-03	mg/kg-day	Spleen	3000	IRIS	08/22/88
4-Chloroaniline	Chronic	4.0E-03	mg/kg-day	0.5	2.0E-03	mg/kg-day	Spleen	3000	IRIS	08/22/88
Propanil	Chronic	5.0E-03	mg/kg-day	0.5	2.5E-03	mg/kg-day	Spleen	1000/1	IRIS	03/01/88
Pentachlorophenol	Chronic	3.0E-02	mg/kg-day	0.5	1.5E-02	mg/kg-day	Liver & kidney	100	IRIS	03/01/91
Acetone	Chronic	1.0E-01	mg/kg-day	0.8	8.0E-02	mg/kg-day	Liver, kidney & blood	1000/1	IRIS	07/01/90
Bromoform	Chronic	2.0E-02	mg/kg-day	0.8	1.6E-02	mg/kg-day	Liver	1000/1	IRIS	12/01/93
Chloroethane	ND	4.0E-01	mg/kg-day	0.8	3.2E-01	mg/kg-day	ND	ND	Region 6	05/01/99
4-Methyl-2-pentanone	Chronic	8.0E-02	mg/kg-day	0.8	6.4E-02	mg/kg-day	Whole body, liver & kidney	3000	HEAST	07/01/97
4-Methyl-2-pentanone	Subchronic	8.0E-01	mg/kg-day	0.8	6.4E-01	mg/kg-day	Whole body, liver & kidney	300	HEAST	07/01/97

TABLE 58
NON-CANCER TOXICITY DATA -- ORAL/DERMAL
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Oral to Dermal Adjustment Factor	Adjusted Dermal RfD	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfD Target Organ	Dates of RfD Target Organ (3)
2,6-Dinitrotoluene	Subchronic	1.0E-02	mg/kg-day	0.5	5.0E-03	mg/kg-day	Whole bodym, neurotoxicity, methemoglobinemia, hyperplasia, Heinz bodies,	300	HEAST	07/01/97
Toluene	Chronic	2.0E-01	mg/kg-day	0.8	1.6E-01	mg/kg-day	Liver & kidney	1000	IRIS	08/01/92
Trichloroethene	ND	6.0E-03	mg/kg-day	0.8	4.8E-03	mg/kg-day	ND	ND	Region 6	05/01/99
Benzene	ND	3.0E-03	mg/kg-day	0.8	2.4E-03	mg/kg-day	ND	ND	Region 6	05/01/99
Barium	Subchronic	7.0E-02	mg/kg-day	0.2	1.4E-02	mg/kg-day	NOAEL	3/1	IRIS	01/21/99
Barium	Subchronic	7.0E-02	mg/kg-day	0.2	1.4E-02	mg/kg-day	Cardiovascular	3	HEAST	07/01/97
Cadmium	Chronic	5.0E-04	mg/kg-day	0.2	1.0E-04	mg/kg-day	Proteinuria	10/1	IRIS	01/01/91
Cadmium	Subchronic	N/A	N/A	0.2	N/A	N/A	N/A	ND	HEAST	07/01/97
Lead	ND	ND	ND	ND	ND	ND	ND	ND	IRIS	03/01/88
Selenium	Chronic	5.0E-03	mg/kg-day	0.2	1.0E-03	mg/kg-day	Whole body	3/1	IRIS	06/01/91
Selenium	Subchronic	5.0E-03	mg/kg-day	0.2	1.0E-03	mg/kg-day	Whole body	3	HEAST	07/01/97
Silver	Chronic	5.0E-03	mg/kg-day	0.2	1.0E-03	mg/kg-day	Skin	3/1	IRIS	12/01/91
Silver	Subchronic	5.0E-03	mg/kg-day	0.2	1.0E-03	mg/kg-day	Skin	3	HEAST	07/01/97
4,4'-DDD	ND	ND	ND	ND	ND	ND	ND	ND	IRIS	08/22/88
4,4'-DDE	ND	ND	ND	ND	ND	ND	ND	ND	IRIS	08/22/88
4,4'-DDT	Chronic	5.0E-04	mg/kg-day	0.5	2.5E-04	mg/kg-day	Liver	100/1	IRIS	01/01/91
4,4'-DDT	Subchronic	5.0E-04	mg/kg-day	0.5	2.5E-04	mg/kg-day	Liver	100/1	HEAST	07/01/97
alpha-BHC	ND	ND	ND	ND	ND	ND	ND	ND	IRIS	01/01/91
beta-BHC	ND	ND	ND	ND	ND	ND	ND	ND	IRIS	01/01/91
delta-BHC	ND	ND	ND	ND	ND	ND	ND	ND	IRIS	03/31/87
Endosulfan I	Chronic	6.0E-03	mg/kg-day	0.5	3.0E-03	mg/kg-day	Whole body, kidney, & blood vessel	100/1	IRIS	10/01/94
Endosulfan I	Subchronic	6.0E-03	mg/kg-day	0.5	3.0E-03	mg/kg-day	Whole body, kidney, & blood vessel	100	HEAST	07/01/97
Endosulfan II	Chronic	6.0E-03	mg/kg-day	0.5	3.0E-03	mg/kg-day	Whole body, kidney, & blood vessel	100/1	IRIS	10/01/94
Endosulfan II	Subchronic	6.0E-03	mg/kg-day	0.5	3.0E-03	mg/kg-day	Whole body, kidney, & blood vessel	100	HEAST	07/01/97
Endosulfan sulfate	Chronic	6.0E-03	mg/kg-day	0.5	3.0E-03	mg/kg-day	Whole body, kidney, & blood vessel	100/1	IRIS	10/01/94
Endrin	Chronic	3.0E-04	mg/kg-day	0.5	1.5E-04	mg/kg-day	CNS & liver	100/1	IRIS	10/01/89
Endrin	Subchronic	3.0E-04	mg/kg-day	0.5	1.5E-04	mg/kg-day	CNS & liver	100	HEAST	07/01/97
Endrin ketone	Chronic	3.0E-04	mg/kg-day	0.5	1.5E-04	mg/kg-day	CNS & liver	100/1	IRIS	10/01/89
gamma-BHC	Chronic	3.0E-04	mg/kg-day	0.5	1.5E-04	mg/kg-day	Liver & kidney	1000/1	IRIS	03/01/88
gamma-BHC	Subchronic	3.0E-03	mg/kg-day	0.5	1.5E-03	mg/kg-day	Liver & kidney	100	HEAST	07/01/97

TABLE 58
NON-CANCER TOXICITY DATA -- ORAL/DERMAL
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Oral to Dermal Adjustment Factor	Adjusted Dermal RfD	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfD Target Organ	Dates of RfD: Target Organ (3)
gamma-Chlordane	Chronic	5.0E-04	mg/kg-day	0.5	2.5E-04	mg/kg-day	Liver	300/1	IRIS	02/07/98
gamma-Chlordane	Subchronic	6.0E-05	mg/kg-day	0.5	3.0E-05	mg/kg-day	Liver	1000	HEAST	07/01/97
1,2,4-Trichlorobenzene	Chronic	1.0E-02	mg/kg-day	0.5	5.0E-03	mg/kg-day	Nervous system	1000/1	IRIS	05/01/92
1,2,4-Trichlorobenzene	Subchronic	1.0E-02	mg/kg-day	0.5	5.0E-03	mg/kg-day	Adrenal	1000	HEAST	07/01/97
1,4-Dichlorobenzene	Chronic	3.0E-02	mg/kg-day	0.5	1.5E-02	mg/kg-day	ND	ND	Region 6	05/01/99
2-Chloronaphthalene	Chronic	8.0E-02	mg/kg-day	0.5	4.0E-02	mg/kg-day	Liver	3000/1	IRIS	11/01/90
2-Methylphenol (o-cresol)	Chronic	5.0E-02	mg/kg-day	0.5	2.5E-02	mg/kg-day	Whole body & nervous system	1000/1	IRIS	04/01/92
2-Methylphenol (o-cresol)	Subchronic	5.0E-01	mg/kg-day	0.5	2.5E-01	mg/kg-day	Whole body & nervous system	100	HEAST	07/01/97
2-Nitrophenol	N/A	8.0E-03	mg/kg-day	0.5	4.0E-03	mg/kg-day	N/A	N/A	Region 6	05/01/99
2,4-Dinitrophenol	Chronic	2.0E-03	mg/kg-day	0.5	1.0E-03	mg/kg-day	Eye	1000/1	IRIS	10/01/91
2,4-Dinitrophenol	Subchronic	2.0E-03	mg/kg-day	0.5	1.0E-03	mg/kg-day	Eye	1000	HEAST	07/01/97
4-Nitrophenol	N/A	8.0E-03	mg/kg-day	0.5	4.0E-03	mg/kg-day	N/A	ND	Region 6	05/01/99
Benzoic acid	Chronic	4.0E+00	mg/kg-day	0.5	2.0E+00	mg/kg-day	NOAEL	1/1	IRIS	06/01/91
Benzoic acid	Subchronic	4.0E+00	mg/kg-day	0.5	2.0E+00	mg/kg-day	NOAEL	1	HEAST	07/01/97
bis(2-Ethylhexyl)phthalate	Chronic	2.0E-02	mg/kg-day	0.5	1.0E-02	mg/kg-day	Liver	1000/1	IRIS	09/07/88
Dimethylphthalate	Chronic	1.0E+01	mg/kg-day	0.5	5.0E+00	mg/kg-day	N/A	ND	Region 6	05/01/99
Di-n-butylphthalate	Chronic	1.0E-01	mg/kg-day	0.5	5.0E-02	mg/kg-day	Whole body	1000/1	IRIS	10/01/90
Di-n-butylphthalate	Subchronic	1.0E+00	mg/kg-day	0.5	5.0E-01	mg/kg-day	Whole body	100	HEAST	07/01/97
Di-n-octylphthalate	Subchronic	2.0E-02	mg/kg-day	0.5	1.0E-02	mg/kg-day	Kidney & liver	1000	HEAST	07/01/97
Fluoranthene	Chronic	4.0E-02	mg/kg-day	0.5	2.0E-02	mg/kg-day	Kidney, liver & blood	3000/1	IRIS	12/01/90
Fluoranthene	Subchronic	4.0E-01	mg/kg-day	0.5	2.0E-01	mg/kg-day	Kidney, liver & blood	300	HEAST	07/01/97
Isophorone	Chronic	2.0E-01	mg/kg-day	0.5	1.0E-01	mg/kg-day	Kidney	1000/1	IRIS	10/01/92
Isophorone	Subchronic	2.0E+01	mg/kg-day	0.5	1.0E+01	mg/kg-day	Kidney	100	HEAST	07/01/97
Phenol	Chronic	6.0E-01	mg/kg-day	0.5	3.0E-01	mg/kg-day	Fetus	100/1	IRIS	03/01/91
Phenol	Subchronic	6.0E-01	mg/kg-day	0.5	3.0E-01	mg/kg-day	Fetus	100	HEAST	07/01/97
Pyrene	Chronic	3.0E-02	mg/kg-day	0.5	1.5E-02	mg/kg-day	Kidney	3000/1	IRIS	01/01/91
Pyrene	Subchronic	3.0E-01	mg/kg-day	0.5	1.5E-01	mg/kg-day	Kidney	300	HEAST	07/01/97
Bromodichloromethane	Chronic	2.0E-02	mg/kg-day	0.8	1.6E-02	mg/kg-day	Kidney	1000/1	IRIS	03/01/93
1,1-Dichloroethene	Chronic	9.0E-03	mg/kg-day	0.8	7.2E-03	mg/kg-day	Liver	1000/1	IRIS	02/01/98
1,1-Dichloroethene	Subchronic	9.0E-03	mg/kg-day	0.8	7.2E-03	mg/kg-day	Liver	1000	HEAST	07/01/97
1,2-Dichlorobenzene	Chronic	9.0E-02	mg/kg-day	0.8	7.2E-02	mg/kg-day	Whole body	1000/1	IRIS	11/01/90
1,2-Dichlorobenzene	Subchronic	ND	ND	ND	ND	ND	ND	ND	HEAST	07/01/97
1,2-Dichloropropane	Chronic	ND	ND	ND	ND	ND	ND	ND	IRIS	12/01/91
1,2-Dichloropropane	Subchronic	ND	ND	ND	ND	ND	ND	ND	HEAST	07/01/97
bis(2-Chloroethyl)ether	Chronic	ND	ND	ND	ND	ND	ND	ND	IRIS	10/01/91

TABLE 58
NON-CANCER TOXICITY DATA -- ORAL/DERMAL
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Oral to Dermal Adjustment Factor	Adjusted Dermal RfD	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfD: Target Organ	Dates of RfD Target Organ (3)
Carbon disulfide	Chronic	1.0E-01	mg/kg-day	0.8	8.0E-02	mg/kg-day	Fetus & PNS	100/1	IRIS	08/01/95
Carbon disulfide	Subchronic	1.0E-01	mg/kg-day	0.8	8.0E-02	mg/kg-day	Fetus & PNS	100	HEAST	07/01/97
Chlorobenzene	Chronic	2.0E-02	mg/kg-day	0.8	1.6E-02	mg/kg-day	Liver	1000/1	IRIS	11/01/90
Ethylbenzene	Chronic	1.0E-01	mg/kg-day	0.8	8.0E-02	mg/kg-day	Liver & kidney	1000/1	IRIS	03/01/91
Ethylbenzene	Subchronic	1.1E-01	mg/kg-day	0.8	8.8E-02	mg/kg-day	ND	ND	DOE (NCEA)	07/01/00
Methyl ethyl ketone	Chronic	6.0E-01	mg/kg-day	0.8	4.8E-01	mg/kg-day	Fetus	3000/1	IRIS	05/01/93
Methyl ethyl ketone	Subchronic	2.0E+00	mg/kg-day	0.8	1.6E+00	mg/kg-day	Fetus	1000	HEAST	07/01/97
Tetrachloroethene	Chronic	1.0E-02	mg/kg-day	0.8	8.0E-03	mg/kg-day	Liver	1000/1	IRIS	03/01/88
Tetrachloroethene	Subchronic	1.0E-01	mg/kg-day	0.8	8.0E-02	mg/kg-day	Liver	100	HEAST	07/01/97
1,1,2-Trichloroethane	Chronic									
Xylene (total)	Chronic	2.0E+00	mg/kg-day	0.8	1.6E+00	mg/kg-day	Whole body & CNS	100/1	IRIS	09/26/88
Xylene (total)	Subchronic	ND	ND	ND	ND	ND	ND	ND	HEAST	07/01/97
4,6-Dinitro-2-methylphenol	ND	1.0E-04	mg/kg-day	0.5	5.0E-05	mg/kg-day	ND	ND	Region 6	05/01/99

RfD = Reference dose
mg/kg-day = milligrams per kilogram day
IRIS = Integrated Risk Information System
NOAEL = No Observed Adverse Effect Level
Region 6 = value presented is the route extrapolation value presented in Region 6 Human Health Medium-Specific Screening Levels (October, 1998).
HEAST = Health Effects Assessment Summary Tables
NCEA = National Center for Environmental Assessment
DOE(NCEA) = Department of Energy obtained value from NCEA. Value posted on DOE website at http://risk.lsd.ornl.gov/.
ND = No data
CNS = Central nervous system
PNS = Peripheral nervous system

(1) Oral to Dermal Adjustment Factors were obtained from the Existing Texas Risk Reduction Rule, (TNRCC, 1998).
(2) The dermal reference dose was calculated using the following equation:
RfDd = RfDo x DAF
(3) For IRIS values, this is the date IRIS was searched. For HEAST values this is the publication date.

TABLE 59
NON-CANCER TOXICITY DATA -- INHALATION
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Chemical of Potential Concern	Chronic/ Subchronic	Value Inhalation RfC	Units	Adjusted Inhalation RfD (1)	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfC:RfD Target Organ	Dates (2) (MM/DD/YY)
Arsenic	ND	ND	ND	ND	ND	ND	ND	IRIS	06/01/95
Barium	Chronic	5.00E-04	mg/m^3	1.43E-04	mg/kg-day	Fetus	1000	HEAST	07/01/97
Barium	Subchronic	5.00E-03	mg/m^3	1.43E-03	mg/kg-day	Fetus	100	HEAST	07/01/97
Chromium	Chronic	1.00E-04	mg/m^3	2.86E-05	mg/kg-day	Lungs	300/1	IRIS	09/03/98
Mercury	Chronic	3.01E-04	mg/m^3	8.6E-05	mg/kg-day	Nervous system	30/1	IRIS	06/01/95
Dieldrin	ND	ND	ND	ND	ND	ND	ND	IRIS	01/01/91
Aldrin	ND	ND	ND	ND	ND	ND	ND	IRIS	01/01/91
Methoxychlor	ND	ND	ND	ND	ND	ND	ND	IRIS	04/01/92
Toxaphene	ND	ND	ND	ND	ND	ND	ND	IRIS	01/01/91
Heptachlor	ND	ND	ND	ND	ND	ND	ND	IRIS	01/01/91
Acetone	ND	ND	ND	ND	ND	ND	ND	IRIS	07/01/90
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	IRIS	03/01/93
Bromoform	ND	ND	ND	ND	ND	ND	ND	IRIS	12/01/93
Chloroethane	ND	1.00E+01	mg/m^3	2.86E+00	mg/kg-day	Fetal skeleton	300/1	IRIS	04/01/91
4-Methyl-2-pentanone	Chronic	8.00E-02	mg/m^3	2.29E-02	mg/kg-day	Liver & kidney	3000	HEAST	07/01/97
4-Methyl-2-pentanone	Subchronic	8.00E-01	mg/m^3	2.29E-01	mg/kg-day	Liver & kidney	300	HEAST	07/01/97
Toluene	Chronic	4.00E-01	mg/m^3	1.14E-01	mg/kg-day	CNS	300/1	IRIS	08/01/92
1,2-Dichloroethane	ND	ND	mg/m^3	1.40E-03	mg/kg-day	ND	ND	NCEA	04/05/93
Carbon tetrachloride	ND	2.00E-03	mg/m^3	5.71E-04	mg/kg-day	ND	ND	Region 6	05/01/99
Chloroform	ND	3.01E-04	mg/m^3	8.60E-05	mg/kg-day	ND	ND	Region 6	05/01/99
Methylene chloride	Chronic	3.01E+00	mg/m^3	8.60E-01	mg/kg-day	Liver	100	HEAST	07/01/97
4-Chloroaniline	ND	ND	ND	ND	ND	ND	ND	IRIS	08/22/88
3,4-Dichloroaniline	ND	ND	ND	ND	ND	ND	ND	IRIS	08/22/88
Propanil	ND	ND	ND	ND	ND	ND	ND	IRIS	03/01/88
Pentachlorophenol	ND	ND	ND	ND	ND	ND	ND	IRIS	03/01/91
Cadmium	ND	2.00E-04	mg/m^3	5.71E-05	mg/kg-day	ND	ND	Region 6	05/01/99
Lead	ND	ND	ND	ND	ND	ND	ND	IRIS	03/01/88
Selenium	ND	ND	ND	ND	ND	ND	ND	IRIS	06/01/91
Silver	ND	ND	ND	ND	ND	ND	ND	IRIS	12/01/91
4,4'-DDD	ND	ND	ND	ND	ND	ND	ND	IRIS	08/22/88
4,4'-DDE	ND	ND	ND	ND	ND	ND	ND	IRIS	08/22/88
4,4-DDT	ND	ND	ND	ND	ND	ND	ND	IRIS	01/01/91
alpha-BHC	ND	ND	ND	ND	ND	ND	ND	IRIS	01/01/91
beta-BHC	ND	ND	ND	ND	ND	ND	ND	IRIS	01/01/91
delta-BHC	ND	ND	ND	ND	ND	ND	ND	IRIS	03/31/87
Endosulfan I	ND	ND	ND	ND	ND	ND	ND	IRIS	10/01/94
Endosulfan II	ND	ND	ND	ND	ND	ND	ND	IRIS	10/01/94
Endosulfan sulfate	ND	ND	ND	ND	ND	ND	ND	IRIS	10/01/94
Endrin	ND	ND	ND	ND	ND	ND	ND	IRIS	10/01/89
Endrin ketone	ND	ND	ND	ND	ND	ND	ND	IRIS	10/01/89
gamma-BHC	ND	ND	ND	ND	ND	ND	ND	IRIS	03/01/88

TABLE 59
NON-CANCER TOXICITY DATA -- INHALATION
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Chemical of Potential Concern	Chronic/ Subchronic	Value Inhalation RfC	Units	Adjusted Inhalation RfD (1)	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfC:RfD: Target Organ	Dates (2) (MM/DD/YY)
gamma-Chlordane	Chronic	7.00E-04	mg/m^3	2.00E-04	mg/kg-day	Liver	1000/1	IRIS	02/07/98
1,2,4-Trichlorobenzene	Chronic	2.00E-01	mg/m^3	5.71E-02	mg/kg-day	Liver	1000	HEAST	07/01/97
1,2,4-Trichlorobenzene	Subchronic	2.00E+00	mg/m^3	5.71E-01	mg/kg-day	Liver	100	HEAST	07/01/97
1,4-Dichlorobenzene	ND	8.02E-01	mg/m^3	2.29E-01	mg/kg-day	Liver	100/1	IRIS	01/01/94
2-Chloronaphthalene	ND	ND	ND	ND	ND	ND	ND	IRIS	11/01/90
2-Methylphenol (o-cresol)	ND	ND	ND	ND	ND	ND	ND	IRIS	04/01/92
2-Nitrophenol	ND	ND	ND	ND	ND	ND	ND	IRIS	10/01/91
2,4-Dinitrophenol	ND	ND	ND	ND	ND	ND	ND	IRIS	10/01/91
4-Nitrophenol	ND	ND	ND	ND	ND	ND	ND	IRIS	10/01/91
Benzoic acid	ND	ND	ND	ND	ND	ND	ND	IRIS	06/01/91
bis(2-Ethylhexyl)phthalate	ND	ND	ND	ND	ND	ND	ND	IRIS	09/07/88
Dimethylphthalate	ND	ND	ND	ND	ND	ND	ND	IRIS	09/01/90
Di-n-butylphthalate	ND	ND	ND	ND	ND	ND	ND	IRIS	10/01/90
Di-n-octylphthalate	ND	ND	ND	ND	ND	ND	ND	HEAST	07/01/97
Dinoseb	ND	ND	ND	ND	ND	ND	ND	IRIS	08/01/89
Fluoranthene	ND	ND	ND	ND	ND	ND	ND	IRIS	12/01/90
Isophorone	ND	ND	ND	ND	ND	ND	ND	IRIS	10/01/92
Phenol	ND	ND	ND	ND	ND	ND	ND	IRIS	03/01/91
Pyrene	ND	ND	ND	ND	ND	ND	ND	IRIS	01/01/91
Dibromochloromethane	ND	ND	ND	ND	ND	ND	ND	IRIS	11/01/90
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	IRIS	
1,2-Dichlorobenzene	Chronic	2.00E-01	mg/m^3	5.71E-02	mg/kg-day	Whole body	1.00E+03	HEAST	07/01/97
1,2-Dichlorobenzene	Subchronic	2.00E+00	mg/m^3	5.71E-01	mg/kg-day	Whole body	1.00E+02	HEAST	07/01/97
1,2-Dichloropropane	Chronic	3.99E-03	mg/m^3	1.14E-03	mg/kg-day	Nasal mucosa	300/1	IRIS	12/01/91
1,2-Dichloropropane	Subchronic	1.30E-02	mg/m^3	3.71E-03	mg/kg-day	Nasal mucosa	100	HEAST	07/01/97
2,6-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND	HEAST	07/01/97
Benzene	ND	5.95E-03	mg/m^3	1.70E-03	mg/kg-day	ND	ND	Region 6	05/01/99
bis(2-Chloroethyl)ether	ND	ND	ND	ND	ND	ND	ND	IRIS	10/01/91
Carbon disulfide	ND	7.00E-01	mg/m^3	2.00E-01	mg/kg-day	PNS	30/1	IRIS	08/01/95
Chlorobenzene	ND	5.95E-02	mg/m^3	1.70E-02	mg/kg-day	ND	ND	Region 6	05/01/99
Chlorobenzene	Chronic	2.00E-02	mg/m^3	5.71E-03	mg/kg-day	Liver/kidney	10,000	HEAST	07/01/97
Ethylbenzene	ND	1.00E+00	mg/m^3	2.86E-01	mg/kg-day	ND	300/1	IRIS	03/01/91
Methyl ethyl ketone (2-Butanone)	Chronic	1.00E+00	mg/m^3	2.86E-01	mg/kg-day	Fetus	1000/3	IRIS	05/01/93
Methyl ethyl ketone (2-Butanone)	Subchronic	1.00E+00	mg/m^3	2.86E-01	mg/kg-day	Fetus	3000	HEAST	07/01/97
Tetrachloroethene	ND	4.90E-01	mg/m^3	1.40E-01	mg/kg-day	ND	ND	Region 6	05/01/99
Trichloroethene	ND	ND	ND	ND	ND	ND	ND	IRIS	07/01/89

TABLE 59
NON-CANCER TOXICITY DATA -- INHALATION
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Chemical of Potential Concern	Chronic/ Subchronic	Value Inhalation RfC	Units	Adjusted Inhalation RfD (1)	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfC:RfD: Target Organ	Dates (2) (MM/DD/YY)
Xylene (total)	ND	ND	ND	ND	ND	ND	ND	IRIS	09/26/88
4,6-Dinitro-2-methylphenol	ND	ND	ND	ND	ND	ND	ND	Region 6	05/01/99

RfC = Reference concentration
RfD = Reference Dose
ND = No Data
IRIS = Integrated Risk Information System
NCEA = National Center for Environmental Assessment
PNS = Peripheral nervous system

(1) The inhalation RfD was calculated using the following equation:
Inhalation RfD = (RfC x 20 m^3/day) / 70 kg

(2) For IRIS values, date IRIS was searched. For HEAST values, date of publication. For NCEA values, date of provisional guidance paper. For Region 6 values, date of screening level table.

TABLE 60
CANCER TOXICITY DATA -- ORAL/DERMAL
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Chemical of Potential Concern	Oral Cancer Slope Factor (CSFo)	Oral to Dermal Adjustment Factor	Adjusted Dermal Cancer Slope Factor (1) (CSFd)	Units	Weight of Evidence/ Cancer Guideline Description	Source	Date (2) (MM/DD/YY)
Arsenic	1.5E+00	1	1.5E+00	$(mg/kg\text{-}day)^{-1}$	A	IRIS	06/01/95
Barium	N/A	N/A	N/A	N/A	N/A	IRIS	01/21/99
Chromium	N/A	N/A	N/A	N/A	N/A	IRIS	09/03/98
Mercury	N/A	N/A	N/A	N/A	N/A	IRIS	06/01/95
Dieldrin	1.6E+01	0.5	3.2E+01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	01/01/91
Aldrin	1.7E+01	0.5	3.4E+01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	01/01/91
Methoxychlor	N/A	N/A	N/A	N/A	N/A	IRIS	04/01/92
Toxaphene	1.10E+00	0.5	2.2E+00	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	01/01/91
Heptachlor	4.5E+00	0.5	9.0E+00	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	01/01/91
Bromodichloromethane	6.2E-02	0.8	7.8E-02	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	03/01/93
Dibromochloromethane	8.4E-02	0.8	1.1E-01	$(mg/kg\text{-}day)^{-1}$	C	IRIS	11/01/90
1,2-Dichloroethane	9.1E-02	0.8	1.1E-01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	01/01/91
Carbon tetrachloride	1.3E-01	0.8	1.6E-01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	01/01/91
Chloroform	6.1E-03	0.8	7.6E-03	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	01/01/91
Methylene chloride	7.5E-03	0.8	9.4E-03	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	01/01/91
Dinoseb	N/A	N/A	N/A	N/A	N/A	IRIS	08/01/89
4-Chloroaniline	N/A	N/A	N/A	N/A	N/A	IRIS	08/22/88
3,4-Dichloroaniline	N/A	N/A	N/A	N/A	N/A	IRIS	08/22/88
Propanil	N/A	N/A	N/A	N/A	N/A	IRIS	03/01/88
Pentachlorophenol	1.2E-01	0.5	2.4E-01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	03/01/91
Acetone	N/A	N/A	N/A	N/A	N/A	IRIS	07/01/90
Bromoform	7.9E-03	0.8	9.9E-03	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	12/01/93
Chloroethane	2.9E-03	0.8	3.6E-03	$(mg/kg\text{-}day)^{-1}$	N/A	Region 6	05/01/99
4-Methyl-2-pentanone	N/A	N/A	N/A	N/A	N/A	IRIS	03/01/91
Toluene	N/A	N/A	N/A	N/A	N/A	IRIS	08/01/92
Cadmium	N/A	N/A	N/A	N/A	N/A	IRIS	01/01/91
Lead	N/A	N/A	N/A	N/A	N/A	IRIS	03/01/88
Selenium	N/A	N/A	N/A	N/A	N/A	IRIS	06/01/91

TABLE 60
CANCER TOXICITY DATA -- ORAL/DERMAL
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Chemical of Potential Concern	Oral Cancer Slope Factor (CSFo)	Oral to Dermal Adjustment Factor	Adjusted Dermal Cancer Slope Factor (1) (CSFd)	Units	Weight of Evidence/ Cancer Guideline Description	Source	Date (2) (MM/DD/YY)
Silver	N/A	N/A	N/A	N/A	N/A	IRIS	12/01/91
4,4'-DDD	2.4E-01	0.5	4.8E-01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	08/22/88
4,4'-DDE	3.4E-01	0.5	6.8E-01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	08/22/88
4,4'-DDT	3.4E-01	0.5	6.8E-01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	01/01/91
alpha-BHC	6.3E+00	0.5	1.3E+01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	01/01/91
beta-BHC	1.8E+00	0.5	3.6E+00	$(mg/kg\text{-}day)^{-1}$	C	IRIS	01/01/91
delta-BHC	N/A	N/A	N/A	N/A	N/A	IRIS	03/31/87
Endosulfan I	N/A	N/A	N/A	N/A	N/A	IRIS	10/01/94
Endosulfan II	N/A	N/A	N/A	N/A	N/A	IRIS	10/01/94
Endosulfan sulfate	N/A	N/A	N/A	N/A	N/A	IRIS	10/01/94
Endrin	N/A	N/A	N/A	N/A	N/A	IRIS	10/01/89
Endrin ketone	N/A	N/A	N/A	N/A	N/A	IRIS	10/01/89
gamma-BHC	1.3E+00	0.5	2.6E+00	$(mg/kg\text{-}day)^{-1}$	B2-C	HEAST	07/01/97
gamma-Chlordane	3.5E-01	0.5	7.0E-01	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	02/07/98
1,2,4-Trichlorobenzene	N/A	N/A	N/A	N/A	N/A	IRIS	05/01/92
1,4-Dichlorobenzene	2.4E-02	0.5	4.8E-02	$(mg/kg\text{-}day)^{-1}$	C	HEAST	07/01/97
2-Chloronaphthalene	N/A	N/A	N/A	N/A	N/A	IRIS	11/01/90
2-Methylphenol (o-cresol)	N/A	N/A	N/A	N/A	N/A	IRIS	04/01/92
2-Nitrophenol	N/A	N/A	N/A	N/A	N/A	IRIS	10/01/91
2,4-Dinitrophenol	N/A	N/A	N/A	N/A	N/A	IRIS	10/01/91
2,6-Dinitrotoluene	6.8E-01	0.5	1.4E+00	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	09/01/90
4-Nitrophenol	N/A	N/A	N/A	N/A	N/A	IRIS	10/01/91
Benzoic acid	N/A	N/A	N/A	N/A	N/A	IRIS	06/01/91
bis(2-Ethylhexyl)phthalate	1.4E-02	0.5	2.8E-02	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	09/07/88
Dimethylphthalate	N/A	N/A	N/A	N/A	N/A	IRIS	09/01/90
Di-n-butylphthalate	N/A	N/A	N/A	N/A	N/A	IRIS	10/01/90
Di-n-octylphthalate	N/A	N/A	N/A	N/A	N/A	HEAST	07/01/97
Fluoranthene	N/A	N/A	N/A	N/A	N/A	IRIS	12/01/90

TABLE 60
CANCER TOXICITY DATA -- ORAL/DERMAL
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Chemical of Potential Concern	Oral Cancer Slope Factor (CSFo)	Oral to Dermal Adjustment Factor	Adjusted Dermal Cancer Slope Factor (1) (CSFd)	Units	Weight of Evidence/ Cancer Guideline Description	Source	Date (2) (MM/DD/YY)
Isophorone	9.5E-04	0.5	1.9E-03	$(mg/kg\text{-}day)^{-1}$	C	IRIS	10/01/92
Phenol	N/A	N/A	N/A	N/A	N/A	IRIS	03/01/91
Pyrene	N/A	N/A	N/A	N/A	N/A	IRIS	01/01/91
1,1-Dichloroethene	6.0E-01	0.8	7.5E-01	$(mg/kg\text{-}day)^{-1}$	C	IRIS	02/01/98
1,2-Dichlorobenzene	N/A	N/A	N/A	N/A	N/A	IRIS	11/01/90
1,2-Dichloropropane	6.8E-02	0.8	8.5E-02	$(mg/kg\text{-}day)^{-1}$	B2	HEAST	07/01/97
Benzene	5.5E-02	0.8	6.9E-02	$(mg/kg\text{-}day)^{-1}$	A	IRIS	01/19/00
bis(2-Chloroethyl)ether	1.1E+00	0.8	1.4E+00	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	10/01/91
Carbon disulfide	N/A	N/A	N/A	N/A	N/A	IRIS	08/01/95
Chlorobenzene	N/A	N/A	N/A	N/A	N/A	IRIS	11/01/90
Ethylbenzene	N/A	N/A	N/A	N/A	N/A	IRIS	03/01/91
Methyl ethyl ketone (2-Butanone)	N/A	N/A	N/A	N/A	N/A	IRIS	05/01/93
Tetrachloroethene	5.2E-02	0.8	6.5E-02	$(mg/kg\text{-}day)^{-1}$	N/A	Region 6	05/01/99
Trichloroethene	1.1E-02	0.8	1.4E-02	$(mg/kg\text{-}day)^{-1}$	N/A	Region 6	05/01/99
Xylene (total)	N/A	N/A	N/A	N/A	N/A	IRIS	09/26/88
4,6-Dinitro-2-methylphenol	N/A	N/A	N/A	N/A	N/A	Region 6	05/01/99

IRIS = Integrated Risk Information System
N/A = Not Applicable
mg/kg-day = milligrams per kilogram day

(1) Dermal slope factor calculated using the following equation:
CSFd = CSFo / DAF
(2) Date IRIS was searched.

EPA Group:
A - Human carcinogen
B1 - Probable human carcinogen - indicates that limited human data are available
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as a human carcinogen
E - Evidence of noncarcinogenicity

TABLE 61
CANCER TOXICITY DATA -- INHALATION
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Chemical of Potential Concern	Inhalation Cancer Slope Factor	Units	Inhalation Unit Risk	Weight of Evidence/ Cancer Guideline Description	Source	Date (1) (MM/DD/YY)
Arsenic	1.51E+01	$mg/kg\text{-}day^{-1}$	4.30E-03	A	IRIS	06/01/95
Chromium	4.10E+01	$mg/kg\text{-}day^{-1}$	N/A	A	HEAST	07/01/97
Mercury	N/A	N/A	N/A	N/A	IRIS	06/01/95
Dieldrin	1.60E+01	$mg/kg\text{-}day^{-1}$	4.60E-03	B2	IRIS	01/01/91
Aldrin	1.70E+01	$mg/kg\text{-}day^{-1}$	4.90E-03	B2	IRIS	01/01/91
Methoxychlor	N/A	N/A	N/A	N/A	IRIS	04/01/92
Toxaphene	1.12E+00	$mg/kg\text{-}day^{-1}$	3.20E-04	B2	IRIS	01/01/91
Heptachlor	4.55E+00	$mg/kg\text{-}day^{-1}$	1.30E-03	B2	IRIS	01/01/91
Bromodichloromethane	N/A	N/A	N/A	N/A	IRIS	03/01/93
Dibromochloromethane	N/A	N/A	N/A	N/A	IRIS	11/01/90
1,2-Dichloroethane	9.10E-02	$mg/kg\text{-}day^{-1}$	2.60E-05	B2	IRIS	01/01/91
Carbon tetrachloride	5.25E-02	$mg/kg\text{-}day^{-1}$	1.50E-05	B2	IRIS	01/01/91
Chloroform	8.05E-02	$mg/kg\text{-}day^{-1}$	2.30E-05	B2	IRIS	01/01/91
Methylene chloride	1.65E-03	$mg/kg\text{-}day^{-1}$	4.70E-07	B2	IRIS	01/01/91
Dinoseb	N/A	N/A	N/A	N/A	IRIS	08/01/89
4-Chloroaniline	N/A	N/A	N/A	N/A	IRIS	08/22/88
3,4-Dichloroaniline	N/A	N/A	N/A	N/A	IRIS	08/22/88
Propanil	N/A	N/A	N/A	N/A	IRIS	03/01/88
Pentachlorophenol	N/A	N/A	N/A	N/A	IRIS	03/01/91
Barium	N/A	N/A	N/A	N/A	IRIS	01/21/99
Cadmium	6.3E+00	$mg/kg\text{-}day^{-1}$	1.80E-03	B1	IRIS	01/01/91
Lead	N/A	N/A	N/A	N/A	IRIS	03/01/88
Selenium	N/A	N/A	N/A	N/A	IRIS	06/01/91
Silver	N/A	N/A	N/A	N/A	IRIS	12/01/91
4,4'-DDD	N/A	N/A	N/A	N/A	IRIS	08/22/88
4,4'-DDE	N/A	N/A	N/A	N/A	IRIS	08/22/88
4,4'-DDT	3.4E-01	$mg/kg\text{-}day^{-1}$	9.70E-05	B2	IRIS	01/01/91

TABLE 61
CANCER TOXICITY DATA -- INHALATION
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Chemical of Potential Concern	Inhalation Cancer Slope Factor	Units	Inhalation Unit Risk	Weight of Evidence/ Cancer Guideline Description	Source	Date (1) (MM/DD/YY)
alpha-BHC	6.3E+00	$mg/kg\text{-}day^{-1}$	1.80E-03	B2	IRIS	01/01/91
beta-BHC	1.8E+00	$mg/kg\text{-}day^{-1}$	5.30E-04	C	IRIS	01/01/91
delta-BHC	N/A	N/A	N/A	N/A	IRIS	03/31/87
Endosulfan I	N/A	N/A	N/A	N/A	IRIS	10/01/94
Endosulfan II	N/A	N/A	N/A	N/A	IRIS	10/01/94
Endosulfan sulfate	N/A	N/A	N/A	N/A	IRIS	10/01/94
Endrin	N/A	N/A	N/A	N/A	IRIS	10/01/89
Endrin ketone	N/A	N/A	N/A	N/A	IRIS	10/01/89
gamma-BHC	N/A	N/A	N/A	N/A	IRIS	03/01/88
gamma-Chlordane	3.5E-01	$mg/kg\text{-}day^{-1}$	N/A	B2	IRIS	02/07/98
1,2,4-Trichlorobenzene	N/A	N/A	N/A	N/A	IRIS	05/01/92
1,4-Dichlorobenzene	2.2E-02	$mg/kg\text{-}day^{-1}$	N/A	N/A	Region 6	05/01/99
2-Chloronaphthalene	N/A	N/A	N/A	N/A	IRIS	11/01/90
2-Methylphenol (o-cresol)	N/A	N/A	N/A	N/A	IRIS	04/01/92
2-Nitrophenol	N/A	N/A	N/A	N/A	IRIS	10/01/91
2,4-Dinitrophenol	N/A	N/A	N/A	N/A	IRIS	10/01/91
4-Nitrophenol	N/A	N/A	N/A	N/A	IRIS	10/01/91
Benzoic acid	N/A	N/A	N/A	N/A	IRIS	06/01/91
bis(2-Ethylhexyl)phthalate	1.4E-02	$mg/kg\text{-}day^{-1}$	N/A	B2	Region 6	05/01/99
Dimethylphthalate	N/A	N/A	N/A	N/A	IRIS	09/01/90
Di-n-buylphthalate	N/A	N/A	N/A	N/A	IRIS	10/01/90
Di-n-octylphthalate	N/A	N/A	N/A	N/A	HEAST	07/01/97
Fluoranthene	N/A	N/A	N/A	N/A	IRIS	12/01/90
Isophorone	N/A	N/A	N/A	N/A	IRIS	10/01/92
Phenol	N/A	N/A	N/A	N/A	IRIS	03/01/91
Pyrene	N/A	N/A	N/A	N/A	IRIS	01/01/91
1,1-Dichloroethene	1.8E-01	$mg/kg\text{-}day^{-1}$	5.00E-05	C	IRIS	02/01/98

TABLE 61
CANCER TOXICITY DATA -- INHALATION
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Chemical of Potential Concern	Inhalation Cancer Slope Factor	Units	Inhalation Unit Risk	Weight of Evidence/ Cancer Guideline Description	Source	Date (1) (MM/DD/YY)
1,2-Dichlorobenzene	N/A	N/A	N/A	N/A	IRIS	11/01/90
1,2-Dichloropropane	N/A	N/A	N/A	N/A	IRIS	12/01/91
4-Methyl-2-pentanone (MIBK)	N/A	N/A	N/A	N/A	IRIS	03/01/91
Acetone	N/A	N/A	N/A	N/A	IRIS	07/01/90
Benzene	2.9E-02	$mg/kg\text{-}day^{-1}$	7.80E-06	A	IRIS	01/19/00
bis(2-Chloroethyl)ether	1.1E+00	$mg/kg\text{-}day^{-1}$	3.30E-04	B2	IRIS	10/01/91
Carbon disulfide	N/A	N/A	N/A	N/A	IRIS	08/01/95
Chlorobenzene	N/A	N/A	N/A	N/A	IRIS	11/01/90
Ethylbenzene	N/A	N/A	N/A	N/A	IRIS	03/01/91
Methyl ethyl ketone (2-Butanone)	N/A	N/A	N/A	N/A	IRIS	05/01/93
Tetrachloroethene	2.0E-03	$mg/kg\text{-}day^{-1}$	N/A	N/A	Region 6	05/01/99
Toluene	N/A	N/A	N/A	N/A	IRIS	08/01/92
Trichloroethene	6.0E-03	$mg/kg\text{-}day^{-1}$	N/A	N/A	Region 6	05/01/99
Xylene (total)	N/A	N/A	N/A	N/A	IRIS	09/26/88
Bromoform	3.9E-03	$mg/kg\text{-}day^{-1}$	1.10E-06	B2	IRIS	12/01/93
Chloroethane	N/A	N/A	N/A	N/A	IRIS	04/01/91
4,6-Dinitro-2-methylphenol	N/A	N/A	N/A	N/A	Region 6	05/01/99

IRIS = Integrated Risk Information System
mg/m^3 = micrograms per cubic meter
NA = Not Applicable

mg/kg-day = milligram per kilogram per day

(1) For IRIS, this is the date of search. For HEAST

EPA Group:
A - Human carcinogen
B1 - Probable human carcinogen - indicates that limited human data are available
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as a human carcinogen

TABLE 61

CANCER TOXICITY DATA -- INHALATION

CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Chemical of Potential Concern	Inhalation Cancer Slope Factor	Units	Inhalation Unit Risk	Weight of Evidence/ Cancer Guideline Description	Source	Date (1) (MM/DD/YY)

and Region 6, this is the date of publication. E - Evidence of noncarcinogenicity

TABLE 62A
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Subsurface Soil
Exposure Point:	Site 1
Receptor Population:	Construction Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Arsenic	10.6	mg/kg	N/A	N/A	M	1.13E-06	kg/kg-day	3E-04	mg/kg-day	N/A	N/A	0.04
	Dieldrin	0.6	mg/kg	N/A	N/A	M	1.13E-06	kg/kg-day	5E-05	mg/kg-day	N/A	N/A	0.013
	1,2-Dichlorethane	7.5	mg/kg	N/A	N/A	M	1.13E-06	kg/kg-day	3E-02	mg/kg-day	N/A	N/A	0.00028
Inhalation	Arsenic	10.6	mg/kg	N/A	N/A	M	3.56E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Dieldrin	0.6	mg/kg	N/A	N/A	M	3.56E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	1,2-Dichlorethane	7.5	mg/kg	N/A	N/A	M	2.24E-05	kg/kg-day	1.4E-03	mg/kg-day	N/A	N/A	0.12
Dermal	Arsenic	10.6	mg/kg	N/A	N/A	M	2.89E-07	kg/kg-day	3E-04	mg/kg-day	N/A	N/A	0.01
	Dieldrin	0.6	mg/kg	N/A	N/A	M	9.63E-07	kg/kg-day	2.5E-05	mg/kg-day	N/A	N/A	0.02284
	1,2-Dichlorethane	7.5	mg/kg	N/A	N/A	M	9.63E-07	kg/kg-day	2.4E-02	mg/kg-day	N/A	N/A	0.0003
Total Hazard Index Across All Exposure Routes/Pathways													<1

See Table 35 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Media-specific concentration
mg/cu. M = milligrams per cubic meter

TABLE 62B
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Subsurface Soil
Exposure Point:	Site 1
Receptor Population:	Construction Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Arsenic	10.6	mg/kg	N/A	N/A	M	1.61E-08	kg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	3E-07
	Dieldrin	0.59	mg/kg	N/A	N/A	M	1.61E-08	kg/kg-day	1.6E+01	$(mg/kg\text{-}day)^{-1}$	2E-07
	1,2-Dichlorethane	7.5	mg/kg	N/A	N/A	M	1.61E-08	kg/kg-day	9.1E-02	$(mg/kg\text{-}day)^{-1}$	1E-08
Inhalation	Arsenic	10.6	mg/kg	N/A	N/A	M	5.08E-13	kg/kg-day	1.5E+01	$(mg/kg\text{-}day)^{-1}$	8E-11
	Dieldrin	0.59	mg/kg	N/A	N/A	M	5.08E-13	kg/kg-day	1.6E+01	$(mg/kg\text{-}day)^{-1}$	5E-12
	1,2-Dichlorethane	7.5	mg/kg	N/A	N/A	M	3.20E-07	kg/kg-day	9.1E-02	$(mg/kg\text{-}day)^{-1}$	2E-07
Dermal	Arsenic	10.6	mg/kg	N/A	N/A	M	4.13E-09	kg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	7E-08
	Dieldrin	0.59	mg/kg	N/A	N/A	M	1.38E-08	kg/kg-day	3.2E+01	$(mg/kg\text{-}day)^{-1}$	3E-07
	1,2-Dichlorethane	7.5	mg/kg	N/A	N/A	M	1.38E-08	kg/kg-day	1.1E-01	$(mg/kg\text{-}day)^{-1}$	1E-08
										Total Risk Across All Exposure Routes/Pathways	1E-06

See Table 35 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Medium-specific concentration

TABLE 62C
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Sediment
Exposure Medium:	Sediment
Exposure Point:	Site 1
Receptor Population:	Construction Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Arsenic	123	mg/kg	N/A	N/A	M	1.2E-07	kg/kg-day	3E-04	mg/kg-day	N/A	N/A	0.048
	Chromium	82	mg/kg	N/A	N/A	M	1.2E-07	kg/kg-day	3E-03	mg/kg-day	N/A	N/A	0.0032
Dermal	Arsenic	123	mg/kg	N/A	N/A	M	2.9E-07	kg/kg-day	3E-04	mg/kg-day	N/A	N/A	0.12
	Chromium	82	mg/kg	N/A	N/A	M	9.6E-08	kg/kg-day	6E-04	mg/kg-day	N/A	N/A	0.013
Total Hazard Index Across All Exposure Routes/Pathways													<1

See Table 39 for definitions, sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Media-specific concentration
mg/cu. M = milligrams per cubic meter

TABLE 62D
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Sediment
Exposure Medium:	Sediment
Exposure Point:	Site 1
Receptor Population:	Construction Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Arsenic	123	mg/kg	N/A	N/A	M	1.68E-09	kg/kg-day	1.5	$(mg/kg\text{-}day)^{-1}$	3.09E-07
	Chromium	82	mg/kg	N/A	N/A	M	1.68E-09	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
Dermal	Arsenic	123	mg/kg	N/A	N/A	M	4.1E-09	kg/kg-day	1.5	$(mg/kg\text{-}day)^{-1}$	3.81E-06
	Chromium	82	mg/kg	N/A	N/A	M	1.4E-09	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
										Total Risk Across All Exposure Routes/Pathways	4.1E-06

See Table 39 for definitions, sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Medium-specific concentration
ND = No data available

TABLE 62E
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater
Exposure Point:	Perched Groundwater
Receptor Population:	Construction Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Arsenic	0.05	mg/L	N/A	N/A	M	1.9E-04	L/kg-day	3E-04	mg/kg-day	N/A	N/A	0.031
	Barium	1.36	mg/L	N/A	N/A	M	1.9E-04	L/kg-day	7E-02	mg/kg-day	N/A	N/A	0.004
	Cadmium	0.009	mg/L	N/A	N/A	M	1.9E-04	L/kg-day	5E-04	mg/kg-day	N/A	N/A	0.003
	Chromium	0.15	mg/L	N/A	N/A	M	1.9E-04	L/kg-day	3E-05	mg/kg-day	N/A	N/A	0.997
	4,4'-DDT	0.00034	mg/L	N/A	N/A	M	1.9E-04	L/kg-day	5E-04	mg/kg-day	N/A	N/A	0.00013
	Alpha-BHC	0.00002	mg/L	N/A	N/A	M	1.9E-04	L/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	2,6-Dinitrotoluene	0.221	mg/L	N/A	N/A	M	1.9E-04	L/kg-day	1E-02	mg/kg-day	N/A	N/A	0.004
	3,4-Dichloroaniline	**58**	**mg/L**	**N/A**	**N/A**	**M**	**1.9E-04**	**L/kg-day**	**4E-03**	**mg/kg-day**	**N/A**	**N/A**	**3**
	4-Chloroaniline	5.9	mg/L	N/A	N/A	M	1.9E-04	L/kg-day	4E-03	mg/kg-day	N/A	N/A	0.277
	bis(2-Chloroethyl)ether	0.005	mg/L	N/A	N/A	M	1.9E-04	L/kg-day	ND	mg/kg-day	N/A	N/A	N/A
	Dinoseb	0.042	mg/L	N/A	N/A	M	1.9E-04	L/kg-day	1E-03	mg/kg-day	N/A	N/A	0.0079
	1,2-Dichloroethane	29	mg/L	N/A	N/A	M	1.9E-04	L/kg-day	3E-02	mg/kg-day	N/A	N/A	0.2
	4-Methyl-2-Pentanone (MIBK)	2.2	mg/L	N/A	N/A	M	1.9E-04	L/kg-day	8E-01	mg/kg-day	N/A	N/A	0.001
	Acetone	4.8	mg/L	N/A	N/A	M	1.9E-04	L/kg-day	1E-01	mg/kg-day	N/A	N/A	0.009
	Benzene	0.017	mg/L	N/A	N/A	M	1.9E-04	L/kg-day	3E-03	mg/kg-day	N/A	N/A	0.0011
	Chloroform	0.7	mg/L	N/A	N/A	M	1.9E-04	L/kg-day	1E-02	mg/kg-day	N/A	N/A	0.0132
	Methylene chloride	**600**	**mg/L**	**N/A**	**N/A**	**M**	**1.9E-04**	**L/kg-day**	**6E-02**	**mg/kg-day**	**N/A**	**N/A**	**2**
	Trichloroethene	0.028	mg/L	N/A	N/A	M	1.9E-04	L/kg-day	6E-03	mg/kg-day	N/A	N/A	0.0009
Dermal	Arsenic	0.05	mg/L	N/A	N/A	M	7.7E-05	L/kg-day	3E-04	mg/kg-day	N/A	N/A	0.013
	Barium	1.36	mg/L	N/A	N/A	M	7.7E-05	L/kg-day	1.4E-02	mg/kg-day	N/A	N/A	0.007
	Cadmium	0.01	mg/L	N/A	N/A	M	7.7E-05	L/kg-day	1E-04	mg/kg-day	N/A	N/A	0.007
	Chromium	0.15	mg/L	N/A	N/A	M	7.7E-05	L/kg-day	6E-04	mg/kg-day	N/A	N/A	0.019
	4,4'-DDT	0.00034	mg/L	N/A	N/A	M	3.3E-02	L/kg-day	2.5E-04	mg/kg-day	N/A	N/A	0.045
	Alpha-BHC	0.00002	mg/L	N/A	N/A	M	1.5E-03	L/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	2,6-Dinitrotoluene	0.221	mg/L	N/A	N/A	M	1.9E-04	L/kg-day	5E-04	mg/kg-day	N/A	N/A	0.08
	3,4-Dichloroaniline	**58**	**mg/L**	**N/A**	**N/A**	**M**	**2.4E-03**	**L/kg-day**	**2E-03**	**mg/kg-day**	**N/A**	**N/A**	**69**

TABLE 62E
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater
Exposure Point:	Perched Groundwater
Receptor Population:	Construction Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
	4-Chloroaniline	**5.9**	**mg/L**	**N/A**	**N/A**	**M**	**2.4E-03**	**L/kg-day**	**2E-03**	**mg/kg-day**	**N/A**	**N/A**	**7**
	bis(2-Chloroethyl)ether	0.005	mg/L	N/A	N/A	M	1.6E-04	L/kg-day	5E-03	mg/kg-day	N/A	N/A	0.00016
	Dinoseb	0.042	mg/L	N/A	N/A	M	2.2E-03	L/kg-day	5E-04	mg/kg-day	N/A	N/A	0.181
	1,2-Dichloroethane	29	mg/L	N/A	N/A	M	4.1E-04	L/kg-day	2.4E-02	mg/kg-day	N/A	N/A	0.5
	4-Methyl-2-Pentanone (MIBK)	2.2	mg/L	N/A	N/A	M	2.5E-04	L/kg-day	6.4E-02	mg/kg-day	N/A	N/A	0.009
	Acetone	4.8	mg/L	N/A	N/A	M	4.4E-05	L/kg-day	8E-02	mg/kg-day	N/A	N/A	0.003
	Benzene	0.017	mg/L	N/A	N/A	M	1.6E-03	L/kg-day	2.4E-03	mg/kg-day	N/A	N/A	0.011
	Chloroform	0.7	mg/L	N/A	N/A	M	6.9E-04	L/kg-day	8E-03	mg/kg-day	N/A	N/A	0.06
	Methylene chloride	**600**	**mg/L**	**N/A**	**N/A**	**M**	**3.5E-04**	**L/kg-day**	**4.8E-02**	**mg/kg-day**	**N/A**	**N/A**	**4**
	Trichloroethene	0.028	mg/L	N/A	N/A	M	1.2E-03	L/kg-day	4.8E-03	mg/kg-day	N/A	N/A	0.007
												Total Hazard Index Across All Exposure Routes/Pathways	88

(1) Route-Specific (M) EPC selected for hazard calculation.
(2) Subchronic

See Table 42 for definitions and sources of equation variables for pathway-specific intake factor calculations.

mg/L = milligrams per liter
L/kg-day = liters per kilogram day
N/A = not applicable

TABLE 62F
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater
Exposure Point:	Perched Groundwater
Receptor Population:	Construction Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Arsenic	0.05	mg/L	N/A	N/A	M	2.7E-06	L/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	2.0E-07
	Barium	1.36	mg/L	N/A	N/A	M	2.7E-06	L/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Cadmium	0.01	mg/L	N/A	N/A	M	2.7E-06	L/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Chromium	0.15	mg/L	N/A	N/A	M	2.7E-06	L/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	4,4'-DDT	0.00034	mg/L	N/A	N/A	M	2.7E-06	L/kg-day	3.4E-01	$(mg/kg\text{-}day)^{-1}$	3.1E-10
	Alpha-BHC	0.00002	mg/L	N/A	N/A	M	2.7E-06	L/kg-day	3.4E-01	$(mg/kg\text{-}day)^{-1}$	1.8E-11
	2,6-Dinitrotoluene	0.22	mg/L	N/A	N/A	M	2.7E-06	L/kg-day	6.8E-01	$(mg/kg\text{-}day)^{-1}$	4.0E-07
	3,4-Dichloroaniline	58	mg/L	N/A	N/A	M	2.7E-06	L/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	4-Chloroaniline	5.9	mg/L	N/A	N/A	M	2.7E-06	L/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	bis(2-Chloroethyl)ether	0.005	mg/L	N/A	N/A	M	2.7E-06	L/kg-day	1.1E+00	$(mg/kg\text{-}day)^{-1}$	1.5E-08
	Dinoseb	0.04	mg/L	N/A	N/A	M	2.7E-06	L/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	1,2-Dichloroethane	**29**	**mg/L**	**N/A**	**N/A**	**M**	**2.7E-06**	**L/kg-day**	**9.1E-02**	**$(mg/kg\text{-}day)^{-1}$**	**7.1E-06**
	4-Methyl-2-Pentanone (MIBK)	2.2	mg/L	N/A	N/A	M	2.7E-06	L/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Acetone	4.8	mg/L	N/A	N/A	M	2.7E-06	L/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Benzene	0.02	mg/L	N/A	N/A	M	2.7E-06	L/kg-day	5.5E-02	$(mg/kg\text{-}day)^{-1}$	2.5E-09
	Chloroform	0.7	mg/L	N/A	N/A	M	2.7E-06	L/kg-day	9.1E-02	$(mg/kg\text{-}day)^{-1}$	1.7E-07
	Methylene chloride	**600**	**mg/L**	**N/A**	**N/A**	**M**	**2.7E-06**	**L/kg-day**	**7.5E-03**	**$(mg/kg\text{-}day)^{-1}$**	**1.2E-05**
	Trichloroethene	0.028	mg/L	N/A	N/A	M	2.7E-06	L/kg-day	1.1E-02	$(mg/kg\text{-}day)^{-1}$	8.3E-10
Dermal	Arsenic	0.05	mg/L	N/A	N/A	M	1.1E-06	L/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	8.2E-08
	Barium	1.36	mg/L	N/A	N/A	M	1.1E-06	L/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Cadmium	0.01	mg/L	N/A	N/A	M	1.1E-06	L/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Chromium	0.15	mg/L	N/A	N/A	M	1.1E-06	L/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	4,4'-DDT	0.00034	mg/L	N/A	N/A	M	4.7E-04	L/kg-day	6.8E+00	$(mg/kg\text{-}day)^{-1}$	1.1E-06
	Alpha-BHC	0.000020	mg/L	N/A	N/A	M	2.1E-05	L/kg-day	6.8E-01	$(mg/kg\text{-}day)^{-1}$	2.8E-10
	2,6-Dinitrotoluene	0.22	mg/L	N/A	N/A	M	2.8E-06	L/kg-day	1.4E+00	$(mg/kg\text{-}day)^{-1}$	8.3E-07
	3,4-Dichloroaniline	58	mg/L	N/A	N/A	M	3.4E-05	L/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	4-Chloroaniline	5.90	mg/L	N/A	N/A	M	3.4E-05	L/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	bis(2-Chloroethyl)ether	0.005	mg/L	N/A	N/A	M	2.3E-06	L/kg-day	1.4E+00	$(mg/kg\text{-}day)^{-1}$	1.6E-08

TABLE 62F
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater
Exposure Point:	Perched Groundwater
Receptor Population:	Construction Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
	Dinoseb	0.04	mg/L	N/A	N/A	M	3.1E-05	L/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	1,2-Dichloroethane	**29**	**mg/L**	**N/A**	**N/A**	**M**	**5.8E-06**	**L/kg-day**	**1.1E-01**	**$(mg/kg\text{-}day)^{-1}$**	**1.9E-05**
	4-Methyl-2-Pentanone (MIBK)	2.2	mg/L	N/A	N/A	M	3.6E-06	L/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Acetone	4.8	mg/L	N/A	N/A	M	6.3E-07	L/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Benzene	0.02	mg/L	N/A	N/A	M	2.3E-05	L/kg-day	6.9E-02	$(mg/kg\text{-}day)^{-1}$	2.7E-08
	Chloroform	0.7	mg/L	N/A	N/A	M	9.8E-06	L/kg-day	1.1E-01	$(mg/kg\text{-}day)^{-1}$	7.8E-07
	Methylene chloride	**600**	**mg/L**	**N/A**	**N/A**	**M**	**5.0E-06**	**L/kg-day**	**9.4E-03**	**$(mg/kg\text{-}day)^{-1}$**	**2.8E-05**
	Trichloroethene	0.028	mg/L	N/A	N/A	M	1.8E-05	L/kg-day	1.4E-02	$(mg/kg\text{-}day)^{-1}$	6.8E-09
										Total Risk Across All Exposure Routes/Pathways	7E-05

(1) Route-Specific (M) EPC selected for hazard calculation.

See Table 42 for definitions and sources of equation variables for pathway-specific intake factor calculations.

mg/L = milligrams per liter
L/kg-day = liters per kilogram day
N/A = not applicable

TABLE 62G
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface and Subsurface Soil	Site 1	Arsenic	2.6E-07	8.1E-11	6.56E-08	3.2E-07	Arsenic	0.0399	N/A	0.01	0.047
			Dieldrin	1.5E-07	4.9E-12	2.62E-07	4.1E-07	Dieldrin	0.013	N/A	0.023	0.036
			1,2-Dichlorethane	1.1E-08	2.2E-07	1.18E-08	2.4E-07	1,2-Dichlorethane	0.00	0.120	0.000	0.121
Soil	Sediment	Site 1	Arsenic	3.1E-07	N/A	3.8E-06	4.1E-06	Arsenic	0.05	N/A	0.12	0.167
			Chromium	N/A	N/A	N/A	N/A		0.0032	N/A	0.0131	0.016
Groundwater	Perched Groundwater	Site Wide	Arsenic	2.01E-07	N/A	8.2E-08	2.8E-07	Arsenic	0.03	N/A	0.013	0.044
			Barium	N/A	N/A	N/A	N/A	Barium	0.0037	N/A	0.0075	0.011
			Cadmium	N/A	N/A	N/A	N/A	Cadmium	0.0033	N/A	0.0067	0.01
			Chromium	N/A	N/A	N/A	N/A	Chromium	0.9968	N/A	0.019	1.016
			4,4'-DDT	3.10E-10	N/A	1.1E-06	1.1E-06	4,4'-DDT	0.00013	N/A	0.045	0.045
			Alpha-BHC	1.82E-11	N/A	2.8E-10	3.0E-10	Alpha-BHC	N/A	N/A	N/A	N/A
			2,6-Dinitrotoluene	4.03E-07	N/A	8.3E-07	1.2E-06	2,6-Dinitrotoluene	0.00	N/A	0.085	0.089
			3,4-Dichloroaniline	N/A	N/A	N/A	N/A	3,4-Dichloroaniline	**3**	**N/A**	**69.246**	**72**
			4-Chloroaniline	N/A	N/A	N/A	N/A	4-Chloroaniline	**0.28**	**N/A**	**7**	**7**
			bis(2-Chloroethyl)ether	1.48E-08	N/A	1.6E-08	3.1E-08	bis(2-Chloroethyl)ether	N/A	N/A	0.00016	0.00016
			Dinoseb	N/A	N/A	N/A	N/A	Dinoseb	0.0079	N/A	0.181	0.19
			1,2-Dichloroethane	7.08E-06	N/A	1.9E-05	2.6E-05	1,2-Dichloroethane	**0**	**N/A**	**0**	**1**
			4-Methyl-2-Pentanone (MIBK)	N/A	N/A	N/A	N/A	4-Methyl-2-Pentanone (MIBK)	0.0005	N/A	0.0087	0.009
			Acetone	N/A	N/A	N/A	N/A	Acetone	0.009	N/A	0.0026	0.012
			Benzene	2.51E-09	N/A	2.7E-08	3.0E-08	Benzene	0.0011	N/A	0.011	0.013
			Chloroform	1.71E-07	N/A	7.8E-07	9.5E-07	Chloroform	0.0132	N/A	0.06	0.073
			Methylene chloride	1.21E-05	N/A	2.8E-05	4.0E-05	Methylene chloride	**2**	**N/A**	**4**	**6**
			Trichloroethene	8.27E-10	N/A	6.8E-09	7.6E-09	Trichloroethene	0.00088	N/A	0.0072	0.008

Total Risk Across[Soil]	1E-06
Total Risk Across[Sediment]	4E-06
Total Risk Across[Groundwater]	7E-05
Total Risk Across All Media and All Exposure Routes	7E-05
Total Hazard Index Across All Media and All Exposure Routes	88

N/A = Not Applicable

TABLE 63A
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 1 Surface Soil
Receptor Population:	Adult Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Arsenic	14.4	mg/kg	N/A	N/A	M	4.89E-07	kg/kg-day	3E-04	mg/kg-day	N/A	N/A	0.023
	Dieldrin	0.593	mg/kg	N/A	N/A	M	4.89E-07	kg/kg-day	5E-05	mg/kg-day	N/A	N/A	0.006
	1,2-Dichloroethane	7.5	mg/kg	N/A	N/A	M	4.89E-07	kg/kg-day	3E-02	mg/kg-day	N/A	N/A	0.0001
Inhalation	Arsenic	14.4	mg/kg	N/A	N/A	M	1.48E-10	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Dieldrin	0.593	mg/kg	N/A	N/A	M	1.48E-10	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	1,2-Dichloroethane	7.5	mg/kg	N/A	N/A	M	9.32E-05	kg/kg-day	1.4E-03	mg/kg-day	N/A	N/A	0.50
Dermal	Arsenic	14.4	mg/kg	N/A	N/A	M	1.20E-06	kg/kg-day	3E-04	mg/kg-day	N/A	N/A	0.058
	Dieldrin	1	mg/kg	N/A	N/A	M	4.01E-06	kg/kg-day	2.5E-05	mg/kg-day	N/A	N/A	0.095
	1,2-Dichloroethane	7.5	mg/kg	N/A	N/A	M	4.01E-06	kg/kg-day	2.4E-02	mg/kg-day	N/A	N/A	0.001
												Total Hazard Index Across All Exposure Routes/Pathways	<1

See Table 45 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Media-specific concentration
mg/cu. M = milligrams per cubic meter

TABLE 63B
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 1 Surface Soil
Receptor Population:	Adult Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC for Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Arsenic	14.35	mg/kg	N/A	N/A	M	1.75E-07	kg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	3.8E-06
	Dieldrin	0.593	mg/kg	N/A	N/A	M	1.75E-07	kg/kg-day	1.6E+01	$(mg/kg\text{-}day)^{-1}$	1.7E-06
	1,2-Dichloroethane	7.5	mg/kg	N/A	N/A	M	1.75E-07	kg/kg-day	9.1E-02	$(mg/kg\text{-}day)^{-1}$	1.2E-07
Inhalation	Arsenic	14.4	mg/kg	N/A	N/A	M	5.29E-11	kg/kg-day	1.5E+01	$(mg/kg\text{-}day)^{-1}$	1.1E-08
	Dieldrin	0.593	mg/kg	N/A	N/A	M	5.29E-11	kg/kg-day	1.6E+01	$(mg/kg\text{-}day)^{-1}$	5.0E-10
	1,2-Dichloroethane	7.5	mg/kg	N/A	N/A	M	3.33E-05	kg/kg-day	9.1E-02	$(mg/kg\text{-}day)^{-1}$	2.3E-05
Dermal	Arsenic	14.4	mg/kg	N/A	N/A	M	4.30E-07	kg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	9.3E-06
	Dieldrin	0.593	mg/kg	N/A	N/A	M	1.43E-06	kg/kg-day	3.2E+01	$(mg/kg\text{-}day)^{-1}$	2.7E-05
	1,2-Dichloroethane	7.5	mg/kg	N/A	N/A	M	1.43E-06	kg/kg-day	1.1E-01	$(mg/kg\text{-}day)^{-1}$	1.2E-06
										Total Risk Across All Exposure Routes/Pathways	7E-05

See Table 45 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Medium-specific concentration

TABLE 63C
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Receptor Population: Adult Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient			
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Site 1	Arsenic	4E-06	1E-08	9E-06	1E-05	Arsenic	0.023	N/A	0.058	0.08
			Dieldrin	2E-06	5E-10	3E-05	3E-05	Dieldrin	0.006	N/A	0.095	0.101
			1,2-Dichloroethane	1E-07	2E-05	1E-06	2E-05	1,2-Dichloroethane	0.000	0.499	0.001	0.501
						Total Risk Across[Soil]	7E-05	tal Hazard Index Across All Media and All Exposure Routes				<1
						Total Risk Across[Groundwater]	N/A					
						Total Risk Across All Media and All Exposure Routes	7E-05					

N/A = Not Applicable

TABLE 64A
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 1 Surface Soil
Receptor Population:	Trespasser
Receptor Age:	Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Arsenic	14.4	mg/kg	N/A	N/A	M	1.58E-07	kg/kg-day	3E-04	mg/kg-day	N/A	N/A	0.008
	Dieldrin	0.593	mg/kg	N/A	N/A	M	1.58E-07	kg/kg-day	5E-05	mg/kg-day	N/A	N/A	0.0019
	1,2-Dichloroethane	7.5	mg/kg	N/A	N/A	M	1.58E-07	kg/kg-day	3E-02	mg/kg-day	N/A	N/A	0.00004
Inhalation	Arsenic	14.4	mg/kg	N/A	N/A	M	3.08E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Dieldrin	0.593	mg/kg	N/A	N/A	M	3.08E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	1,2-Dichloroethane	7.5	mg/kg	N/A	N/A	M	1.94E-05	kg/kg-day	1.4E-03	mg/kg-day	N/A	N/A	0.102
Dermal	Arsenic	14.4	mg/kg	N/A	N/A	M	3.89E-07	kg/kg-day	3E-04	mg/kg-day	N/A	N/A	0.019
	Dieldrin	0.593	mg/kg	N/A	N/A	M	1.30E-06	kg/kg-day	2.5E-05	mg/kg-day	N/A	N/A	0.031
	1,2-Dichloroethane	7.5	mg/kg	N/A	N/A	M	1.30E-06	kg/kg-day	2.4E-02	mg/kg-day	N/A	N/A	0.0004
Total Hazard Index Across All Exposure Routes/Pathways													<1

See Table 49 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Media-specific concentration
mg/cu. M = milligrams per cubic meter

TABLE 64B
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 1 Surface Soil
Receptor Population:	Trespasser
Receptor Age:	Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Arsenic	14.35	mg/kg	N/A	N/A	M	2.26E-08	kg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	4.9E-07
	Dieldrin	0.593	mg/kg	N/A	N/A	M	2.26E-08	kg/kg-day	1.6E+01	$(mg/kg\text{-}day)^{-1}$	2.1E-07
	1,2-Dichloroethane	7.5	mg/kg	N/A	N/A	M	2.26E-08	kg/kg-day	9.1E-02	$(mg/kg\text{-}day)^{-1}$	1.5E-08
Inhalation	Arsenic	14.4	mg/kg	N/A	N/A	M	4.41E-12	kg/kg-day	1.5E+01	$(mg/kg\text{-}day)^{-1}$	9.5E-10
	Dieldrin	0.593	mg/kg	N/A	N/A	M	4.41E-12	kg/kg-day	1.6E+01	$(mg/kg\text{-}day)^{-1}$	4.2E-11
	1,2-Dichloroethane	7.5	mg/kg	N/A	N/A	M	2.77E-06	kg/kg-day	9.1E-02	$(mg/kg\text{-}day)^{-1}$	1.9E-06
Dermal	Arsenic	14.4	mg/kg	N/A	N/A	M	5.56E-08	kg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	1.2E-06
	Dieldrin	0.593	mg/kg	N/A	N/A	M	1.85E-07	kg/kg-day	3.2E+01	$(mg/kg\text{-}day)^{-1}$	3.5E-06
	1,2-Dichloroethane	7.5	mg/kg	N/A	N/A	M	1.85E-07	kg/kg-day	1.1E-01	$(mg/kg\text{-}day)^{-1}$	1.6E-07
										Total Risk Across All Exposure Routes/Pathways	7E-06

See Table 49 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Medium-specific concentration

TABLE 64C
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Sediment
Exposure Medium:	Sediment
Exposure Point:	Site 1
Receptor Population:	Trespasser
Receptor Age:	Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (2)	Reference Dose Unit	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Arsenic	123	mg/kg	N/A	N/A	M	3.2E-07	kg/kg-day	3E-04	mg/kg-day	N/A	N/A	0.13
	Chromium	82	mg/kg	N/A	N/A	M	3.2E-07	kg/kg-day	3E-03	mg/kg-day	N/A	N/A	0.0087
Dermal	Arsenic	123	mg/kg	N/A	N/A	M	3.9E-07	kg/kg-day	3E-04	mg/kg-day	N/A	N/A	0.160
	Chromium	82	mg/kg	N/A	N/A	M	1.3E-07	kg/kg-day	6E-04	mg/kg-day	N/A	N/A	0.0177
Total Hazard Index Across All Exposure Routes/Pathways													<1

See Table 53 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Media-specific concentration
mg/cu. M = milligrams per cubic meter

TABLE 64D
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Sediment
Exposure Medium:	Sediment
Exposure Point:	Site 1
Receptor Population:	Trespasser
Receptor Age:	Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC for Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Arsenic	123	mg/kg	N/A	N/A	M	4.52E-08	kg/kg-day	1.5	$(mg/kg\text{-}day)^{-1}$	8.34E-06
	Chromium	82	mg/kg	N/A	N/A	M	4.52E-08	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
Dermal	Arsenic	123	mg/kg	N/A	N/A	M	5.6E-08	kg/kg-day	1.5	$(mg/kg\text{-}day)^{-1}$	1.03E-05
	Chromium	82.0	mg/kg	N/A	N/A	M	1.9E-08	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
										Total Risk Across All Exposure Routes/Pathways	1.9E-05

See Table 53 for definitions and sources of equation variables. See Table 53 for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Medium-specific concentration
ND = No data available

TABLE 64E
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Receptor Population: Trespasser
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient			
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Site 1	Arsenic	5E-07	1E-09	1E-06	2E-06	Arsenic	0.008	N/A	0.019	0.0
			Dieldrin	2E-07	4E-11	4E-06	4E-06	Dieldrin	0.002	N/A	0.031	0.033
			1,2-Dichloroethane	2E-08	2E-06	2E-07	2E-06	1,2-Dichloroethane	0.0000	0.102	0.000	0.10
Sediment	Sediment	Site 1	Arsenic	8E-06	N/A	1E-05	2E-05	Arsenic	0.13	N/A	0.16	0.29
			Chromium	N/A	N/A	N/A	N/A	Chromium	0.0087	N/A	0.0177	0.026

Total Risk Across[Soil]	7E-06
Total Risk Across[Sediment]	2E-05
Total Risk Across All Media and All Exposure Routes	3E-05
Total Hazard Index Across All Media and All Exposure Routes	<1

TABLE 65A
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Surface and Subsurface Soil
Exposure Point:	Site 2 Subsurface Soil
Receptor Population:	Construction Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Arsenic	17.9	mg/kg	N/A	N/A	M	1.13E-06	kg/kg-day	3E-04	mg/kg-day	N/A	N/A	0.067
	Chromium	25.2	mg/kg	N/A	N/A	M	1.13E-06	kg/kg-day	3E-03	mg/kg-day	N/A	N/A	0.009
	Aldrin	0.420	mg/kg	N/A	N/A	M	1.13E-06	kg/kg-day	3E-05	mg/kg-day	N/A	N/A	0.0158
	Dieldrin	0.06	mg/kg	N/A	N/A	M	1.13E-06	kg/kg-day	5E-05	mg/kg-day	N/A	N/A	0.0079
	1,2-Dichloroethane	0.81	mg/kg	N/A	N/A	M	1.13E-06	kg/kg-day	3E-02	mg/kg-day	N/A	N/A	3E-05
	Chloroform	0.002	mg/kg	N/A	N/A	M	1.13E-06	kg/kg-day	1E-02	mg/kg-day	N/A	N/A	2E-07
	Methylene chloride	4	mg/kg	N/A	N/A	M	1.13E-06	kg/kg-day	6E-02	mg/kg-day	N/A	N/A	8E-05
Inhalation	Arsenic	17.9	mg/kg	N/A	N/A	M	3.56E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Chromium	25.2	mg/kg	N/A	N/A	M	3.56E-11	kg/kg-day	2.86E-05	mg/kg-day	N/A	N/A	3E-05
	Aldrin	0.420	mg/kg	N/A	N/A	M	3.56E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Dieldrin	0.35	mg/kg	N/A	N/A	M	3.56E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	1,2-Dichloroethane	0.81	mg/kg	N/A	N/A	M	2.24E-05	kg/kg-day	1.4E-03	mg/kg-day	N/A	N/A	1
	Chloroform	0.002	mg/kg	N/A	N/A	M	3.35E-05	kg/kg-day	8.6E-05	mg/kg-day	N/A	N/A	0.0008
	Methylene chloride	4	mg/kg	N/A	N/A	M	3.61E-05	kg/kg-day	8.6E-01	mg/kg-day	N/A	N/A	2E-04
Dermal	Arsenic	17.9	mg/kg	N/A	N/A	M	2.89E-07	kg/kg-day	3E-04	mg/kg-day	N/A	N/A	0.017
	Chromium	25.2	mg/kg	N/A	N/A	M	9.63E-08	kg/kg-day	6E-04	mg/kg-day	N/A	N/A	0.004
	Aldrin	0.420	mg/kg	N/A	N/A	M	9.63E-07	kg/kg-day	1.5E-05	mg/kg-day	N/A	N/A	0.027
	Dieldrin	0.35	mg/kg	N/A	N/A	M	9.63E-07	kg/kg-day	2.5E-05	mg/kg-day	N/A	N/A	0.013
	1,2-Dichloroethane	0.81	mg/kg	N/A	N/A	M	9.63E-07	kg/kg-day	2.4E-02	mg/kg-day	N/A	N/A	3E-05
	Chloroform	0.002	mg/kg	N/A	N/A	M	9.63E-07	kg/kg-day	8E-03	mg/kg-day	N/A	N/A	2E-07
	Methylene chloride	4	mg/kg	N/A	N/A	M	9.63E-07	kg/kg-day	4.8E-02	mg/kg-day	N/A	N/A	8E-05
												Total Hazard Index Across All Exposure Routes/Pathways	1

See Table 35 for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Media-specific concentration
mg/cu. M = milligrams per cubic meter

TABLE 65B
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Surface and Subsurface Soil
Exposure Point:	Site 2 Subsurface Soil
Receptor Population:	Construction Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Arsenic	17.9	mg/kg	N/A	N/A	M	1.61E-08	kg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	4.32E-07
	Chromium	25.2	mg/kg	N/A	N/A	M	1.61E-08	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Aldrin	0.420	mg/kg	N/A	N/A	M	1.61E-08	kg/kg-day	1.7E+01	$(mg/kg\text{-}day)^{-1}$	1.15E-07
	Dieldrin	0.06	mg/kg	N/A	N/A	M	1.61E-08	kg/kg-day	1.6E+01	$(mg/kg\text{-}day)^{-1}$	1.44E-08
	1,2-Dichloroethane	0.81	mg/kg	N/A	N/A	M	1.61E-08	kg/kg-day	9.1E-02	$(mg/kg\text{-}day)^{-1}$	1.19E-09
	Chloroform	0.002	mg/kg	N/A	N/A	M	1.61E-08	kg/kg-day	6.1E-03	$(mg/kg\text{-}day)^{-1}$	1.96E-13
	Methylene chloride	4	mg/kg	N/A	N/A	M	1.61E-08	kg/kg-day	7.5E-03	$(mg/kg\text{-}day)^{-1}$	4.83E-10
Inhalation	Arsenic	17.9	mg/kg	N/A	N/A	M	5.08E-13	kg/kg-day	1.5E+01	$(mg/kg\text{-}day)^{-1}$	1.37E-10
	Chromium	25.2	mg/kg	N/A	N/A	M	5.08E-13	kg/kg-day	4.1E+01	$(mg/kg\text{-}day)^{-1}$	5.25E-10
	Aldrin	0.420	mg/kg	N/A	N/A	M	5.08E-13	kg/kg-day	1.7E+01	$(mg/kg\text{-}day)^{-1}$	3.67E-12
	Dieldrin	0.06	mg/kg	N/A	N/A	M	5.08E-13	kg/kg-day	1.6E+01	$(mg/kg\text{-}day)^{-1}$	4.58E-13
	1,2-Dichloroethane	0.81	mg/kg	N/A	N/A	M	3.20E-07	kg/kg-day	9.1E-02	$(mg/kg\text{-}day)^{-1}$	2.36E-08
	Chloroform	0.002	mg/kg	N/A	N/A	M	4.79E-07	kg/kg-day	8.1E-02	$(mg/kg\text{-}day)^{-1}$	7.72E-11
	Methylene chloride	4	mg/kg	N/A	N/A	M	5.16E-07	kg/kg-day	1.7E-03	$(mg/kg\text{-}day)^{-1}$	3.41E-09
Dermal	Arsenic	17.9	mg/kg	N/A	N/A	M	4.13E-09	kg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	1.11E-07
	Chromium	25.2	mg/kg	N/A	N/A	M	1.38E-09	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Aldrin	0.420	mg/kg	N/A	N/A	M	1.38E-08	kg/kg-day	3.4E+01	$(mg/kg\text{-}day)^{-1}$	1.99E-07
	Dieldrin	0.06	mg/kg	N/A	N/A	M	1.38E-08	kg/kg-day	3.2E+01	$(mg/kg\text{-}day)^{-1}$	2.48E-08
	1,2-Dichloroethane	0.81	mg/kg	N/A	N/A	M	1.38E-08	kg/kg-day	1.1E-01	$(mg/kg\text{-}day)^{-1}$	1.27E-09
	Chloroform	0.002	mg/kg	N/A	N/A	M	1.38E-08	kg/kg-day	7.6E-03	$(mg/kg\text{-}day)^{-1}$	2.10E-13
	Methylene chloride	4	mg/kg	N/A	N/A	M	1.38E-08	kg/kg-day	9.4E-03	$(mg/kg\text{-}day)^{-1}$	5.16E-10
									Total Risk Across All Exposure Routes/Pathways		9.3E-07

See Table 35 for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Medium-specific concentration

TABLE 65C
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient			
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface and Subsurface Soil	Site 2	Arsenic	4E-07	1E-10	1E-07	5E-07	Arsenic	0.067	N/A	2E-02	0.08
			Chromium	N/A	5E-10	N/A	5E-10	Chromium	0.009	3E-05	4E-03	0.0135
			Aldrin	1E-07	4E-12	2E-07	3E-07	Aldrin	0.016	N/A	3E-02	0.043
			Dieldrin	1E-08	5E-13	2E-08	4E-08	Dieldrin	0.008	N/A	1E-02	0.021
			1,2-Dichloroethane	1E-09	2E-08	1E-09	3E-08	1,2-Dichloroethane	0.000	1.33	3E-05	1.33
			Chloroform	2E-13	8E-11	2E-13	8E-11	Chloroform	2E-07	0.00	2E-07	8E-04
			Methylene chloride	5E-10	3E-09	5E-10	4E-09	Methylene chloride	8E-05	2E-04	8E-05	3E-04
Groundwater	Perched Groundwater	Site 2	Arsenic	2E-07	N/A	8E-08	3E-07	Arsenic	0.031	N/A	0.013	0.044
			Barium	N/A	N/A	N/A	N/A	Barium	0.004	N/A	0.007	0.011
			Cadmium	N/A	N/A	N/A	N/A	Cadmium	0.003	N/A	0.007	0.010
			Chromium	N/A	N/A	N/A	N/A	Chromium	0.997	N/A	0.019	1.016
			4,4'-DDT	3E-10	N/A	1E-06	1E-06	4,4'-DDT	0.00013	N/A	0.045	0.045
			Alpha-BHC	2E-11	N/A	3E-10	3E-10	Alpha-BHC	N/A	N/A	N/A	N/A
			2,6-Dinitrotoluene	4E-07	N/A	8E-07	1E-06	2,6-Dinitrotoluene	0.004	N/A	0.085	0.089
			3,4-Dichloroaniline	N/A	N/A	N/A	N/A	3,4-Dichloroaniline	3	N/A	69.246	72
			4-Chloroaniline	N/A	N/A	N/A	N/A	4-Chloroaniline	0.277	N/A	7	7
			bis(2-Chloroethyl)ether	1E-08	N/A	2E-08	3E-08	bis(2-Chloroethyl)ether	N/A	N/A	0.00016	0.00016
			Dinoseb	N/A	N/A	N/A	N/A	Dinoseb	0.008	N/A	0.181	0.189
			1,2-Dichloroethane	7E-06	N/A	2E-05	3E-05	1,2-Dichloroethane	0	N/A	0	1
			4-Methyl-2-Pentanone (MIBK)	N/A	N/A	N/A	N/A	4-Methyl-2-Pentanone (MIBK)	0.001	N/A	0.009	0.009
			Acetone	N/A	N/A	N/A	N/A	Acetone	0.009	N/A	0.003	0.012
			Benzene	3E-09	N/A	3E-08	3E-08	Benzene	0.0011	N/A	0.011	0.013
			Chloroform	2E-07	N/A	8E-07	1E-06	Chloroform	0.013	N/A	0.060	0.073
			Methylene chloride	1E-05	N/A	3E-05	4E-05	Methylene chloride	2	N/A	4	6
			Trichloroethene	8E-10	N/A	7E-09	8E-09	Trichloroethene	0.001	N/A	0.007	0.008
						Total Risk Across[Soil]	9E-07				Total Hazard Index Across All Media and All Exposure Routes	89
						Total Risk Across[Groundwater]	7E-05					
						Total Risk Across All Media and All Exposure Routes	7E-05					

N/A = Not Applicable

TABLE 66A
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 2 Surface Soil
Receptor Population:	Adult Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Aldrin	0.058	mg/kg	N/A	N/A	M	4.89E-07	kg/kg-day	3E-05	mg/kg-day	N/A	N/A	0.001
	Dinoseb	100	mg/kg	N/A	N/A	M	4.89E-07	kg/kg-day	1E-03	mg/kg-day	N/A	N/A	0.049
Inhalation	Aldrin	0.058	mg/kg	N/A	N/A	M	1.48E-10	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Dinoseb	100	mg/kg	N/A	N/A	M	1.48E-10	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
Dermal	Aldrin	0.058	mg/kg	N/A	N/A	M	4.01E-06	kg/kg-day	1.5E-05	mg/kg-day	N/A	N/A	0.016
	Dinoseb	100	mg/kg	N/A	N/A	M	4.01E-06	kg/kg-day	5E-04	mg/kg-day	N/A	N/A	0.802
												Total Hazard Index Across All Exposure Routes/Pathways	<1

See Table 45 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Media-specific concentration
mg/cu. M = milligrams per cubic meter

TABLE 66B
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 2 Surface Soil
Receptor Population:	Adult Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Aldrin	0.058	mg/kg	N/A	N/A	M	1.75E-07	kg/kg-day	1.70E+01	$(mg/kg\text{-}day)^{-1}$	1.72E-07
	Dinoseb	100	mg/kg	N/A	N/A	M	1.75E-07	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
Inhalation	Aldrin	0.058	mg/kg	N/A	N/A	M	5.29E-11	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Dinoseb	100	mg/kg	N/A	N/A	M	5.29E-11	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
Dermal	Aldrin	0.058	mg/kg	N/A	N/A	M	1.43E-06	kg/kg-day	3.40E+01	$(mg/kg\text{-}day)^{-1}$	2.83E-06
	Dinoseb	100	mg/kg	N/A	N/A	M	1.43E-06	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
										Total Risk Across All Exposure Routes/Pathways	3.0E-06

See Table 45 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Medium-specific concentration

TABLE 66C
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Receptor Population: Adult Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient			
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Site 2	Aldrin	2E-07	N/A	2.83E-06	3.0E-06	Aldrin	0.0009	N/A	0.02	0.016
			Dinoseb	N/A	N/A	N/A	N/A	Dinoseb	0.05	N/A	0.8	0.9
						Total Risk Across[Soil]	3.0E-06	Total Hazard Index Across All Media and All Exposure Routes				<1
						Total Risk Across All Media and All Exposure Routes	3.0E-06					

N/A = Not Applicable

TABLE 67A
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 2 Surface Soil
Receptor Population:	Trespasser
Receptor Age:	Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Aldrin	0.058	mg/kg	N/A	N/A	M	1.58E-07	kg/kg-day	3E-05	mg/kg-day	N/A	N/A	0.00031
	Dinoseb	100	mg/kg	N/A	N/A	M	1.58E-07	kg/kg-day	1E-03	mg/kg-day	N/A	N/A	0.016
Inhalation	Aldrin	0.058	mg/kg	N/A	N/A	M	3.08E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Dinoseb	100	mg/kg	N/A	N/A	M	3.08E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
Dermal	Aldrin	0.058	mg/kg	N/A	N/A	M	1.30E-06	kg/kg-day	1.5E-05	mg/kg-day	N/A	N/A	0.005
	Dinoseb	100	mg/kg	N/A	N/A	M	1.30E-06	kg/kg-day	5E-04	mg/kg-day	N/A	N/A	0.26
Total Hazard Index Across All Exposure Routes/Pathways													<1

See Table 49 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Media-specific concentration
mg/cu. M = milligrams per cubic meter

TABLE 67B
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 2 Surface Soil
Receptor Population:	Trespasser
Receptor Age:	Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Aldrin	0.058	mg/kg	N/A	N/A	M	2.26E-08	kg/kg-day	1.7E+01	$(mg/kg\text{-}day)^{-1}$	2.23E-08
	Dinoseb	100	mg/kg	N/A	N/A	M	2.26E-08	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
Inhalation	Aldrin	0.1	mg/kg	N/A	N/A	M	4.41E-12	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Dinoseb	100.0	mg/kg	N/A	N/A	M	4.41E-12	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
Dermal	Aldrin	0.058	mg/kg	N/A	N/A	M	1.85E-07	kg/kg-day	3.4E+01	$(mg/kg\text{-}day)^{-1}$	3.66E-07
	Dinoseb	100	mg/kg	N/A	N/A	M	1.85E-07	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
										Total Risk Across All Exposure Routes/Pathways	3.9E-07

See Table 49 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Medium-specific concentration

TABLE 67C
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Receptor Population: Trespasser
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient			
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Site 2	Aldrin	2E-08	N/A	4E-07	4E-07	Aldrin	0.0003	N/A	0.005	0.0053
			Dinoseb	N/A	N/A	N/A	N/A	Dinoseb	0.02	N/A	0.3	0.3
						Total Risk Across[Soil]	4E-07				Total Hazard Index Across All Media and All Exposure Routes	<1
						Total Risk Across All Media and All Exposure Routes	4E-07					

N/A = Not Applicable

TABLE 68A
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Subsurface Soil
Exposure Point:	Site 3 Subsurface Soil
Receptor Population:	Construction Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Dinoseb	13000	mg/kg	N/A	N/A	M	1.13E-06	kg/kg-day	1E-03	mg/kg-day	N/A	N/A	15
Inhalation	Dinoseb	13000	mg/kg	N/A	N/A	M	3.56E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
Dermal	Dinoseb	13000	mg/kg	N/A	N/A	M	9.63E-07	kg/kg-day	5E-04	mg/kg-day	N/A	N/A	25
Total Hazard Index Across All Exposure Routes/Pathways													40

See Table 35 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Media-specific concentration
mg/cu. M = milligrams per cubic meter

TABLE 68B
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Subsurface Soil
Exposure Point:	Site 3 Subsurface Soil
Receptor Population:	Construction Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Dinoseb	13000	mg/kg	N/A	N/A	M	1.61E-08	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
Inhalation	Dinoseb	13000	mg/kg	N/A	N/A	M	5.08E-13	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
Dermal	Dinoseb	13000	mg/kg	N/A	N/A	M	1.38E-08	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
										Total Risk Across All Exposure Routes/Pathways	N/A

See Table 35 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Medium-specific concentration

TABLE 68C
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Sediment
Exposure Medium:	Sediment
Exposure Point:	Site 3
Receptor Population:	Construction Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Arsenic	8.36	mg/kg	N/A	N/A	M	1.2E-07	kg/kg-day	3E-04	mg/kg-day	N/A	N/A	0.0033
	Aldrin	0.011	mg/kg	N/A	N/A	M	1.2E-07	kg/kg-day	3E-05	mg/kg-day	N/A	N/A	0.000026
	Dieldrin	0.25	mg/kg	N/A	N/A	M	1.2E-07	kg/kg-day	5E-05	mg/kg-day	N/A	N/A	0.00058
	Toxaphene	1.6	mg/kg	N/A	N/A	M	1.2E-07	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Pentachlorophenol	5.3	mg/kg	N/A	N/A	M	1.2E-07	kg/kg-day	3E-02	mg/kg-day	N/A	N/A	0.000021
Dermal	Arsenic	8	mg/kg	N/A	N/A	M	2.9E-07	kg/kg-day	3E-04	mg/kg-day	N/A	N/A	0.01
	Aldrin	0.011	mg/kg	N/A	N/A	M	9.6E-07	kg/kg-day	1.5E-05	mg/kg-day	N/A	N/A	0.0007
	Dieldrin	0.25	mg/kg	N/A	N/A	M	9.6E-07	kg/kg-day	2.5E-05	mg/kg-day	N/A	N/A	0.0094
	Toxaphene	1.6	mg/kg	N/A	N/A	M	9.6E-07	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Pentachlorophenol	5.3	mg/kg	N/A	N/A	M	2.4E-06	kg/kg-day	1.5E-02	mg/kg-day	N/A	N/A	0.00085
													<1

See Table 39 for definitions, sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Media-specific concentration
mg/cu. M = milligrams per cubic meter

TABLE 68D
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Sediment
Exposure Medium:	Sediment
Exposure Point:	Site 3
Receptor Population:	Construction Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Arsenic	8.36	mg/kg	N/A	N/A	M	1.68E-09	kg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	2.10E-08
	Aldrin	0.011	mg/kg	N/A	N/A	M	1.68E-09	kg/kg-day	1.7E+01	$(mg/kg\text{-}day)^{-1}$	3.10E-10
	Dieldrin	0.25	mg/kg	N/A	N/A	M	1.68E-09	kg/kg-day	1.6E+01	$(mg/kg\text{-}day)^{-1}$	6.58E-09
	Toxaphene	1.6	mg/kg	N/A	N/A	M	1.68E-09	kg/kg-day	1.1E+00	$(mg/kg\text{-}day)^{-1}$	2.95E-09
	Pentachlorophenol	5.3	mg/kg	N/A	N/A	M	1.68E-09	kg/kg-day	1.2E-01	$(mg/kg\text{-}day)^{-1}$	1.07E-09
Dermal	Arsenic	8	mg/kg	N/A	N/A	M	4.1E-09	kg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	2.59E-07
	Aldrin	0.011	mg/kg	N/A	N/A	M	1.4E-08	kg/kg-day	3.4E+01	$(mg/kg\text{-}day)^{-1}$	5.08E-09
	Dieldrin	0.25	mg/kg	N/A	N/A	M	1.4E-08	kg/kg-day	3.2E+01	$(mg/kg\text{-}day)^{-1}$	1.08E-07
	Toxaphene	1.6	mg/kg	N/A	N/A	M	1.4E-08	kg/kg-day	2.2E+00	$(mg/kg\text{-}day)^{-1}$	4.84E-08
	Pentachlorophenol	5.3	mg/kg	N/A	N/A	M	3.4E-08	kg/kg-day	2.4E-01	$(mg/kg\text{-}day)^{-1}$	4.37E-08
										Total Risk Across All Exposure Routes/Pathways	5E-07

See Table 39 for definitions, sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Medium-specific concentration
ND = No data available

TABLE 68E
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient			
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Subsurface Soil	Site 3	Dinoseb	N/A	N/A	N/A	N/A	Dinoseb	15	N/A	25	40
Sediment	Sediment	Site 3	Arsenic	2E-08	N/A	3E-07	3E-07	Arsenic	0.0033	N/A	0.01	0.011
			Aldrin	3E-10	N/A	5E-09	N/A	Aldrin	0.000026	N/A	0.0007	0.00073
			Dieldrin	7E-09	N/A	1E-07	1E-07	Dieldrin	0.0006	N/A	0.0094	0.01
			Toxaphene	3E-09	N/A	5E-08	5E-08	Toxaphene	N/A	N/A	N/A	N/A
			Pentachlorophenol	1E-09	N/A	4E-08	N/A	Pentachlorophenol	0.000021	N/A	0.00085	0.00087
						Total Risk Across[Soil]	N/A	tal Hazard Index Across All Media and All Exposure Routes				40
						Total Risk Across All Media and All Exposure Routes	5E-07					

N/A = Not Applicable

TABLE 69A
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timefram	Future
Medium:	Sediment
Exposure Medium:	Sediment
Exposure Point:	Site 3
Receptor Populatio	Trespasser
Receptor Age:	Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation	Intake (Non-Cancer	Intake Non-Cancer Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Arsenic	8.36	mg/kg	N/A	N/A	M	3.2E-07	kg/kg-day	3E-04	mg/kg-day	N/A	N/A	0.009
	Aldrin	0.011	mg/kg	N/A	N/A	M	3.2E-07	kg/kg-day	3E-05	mg/kg-day	N/A	N/A	0.000069
	Dieldrin	0.25	mg/kg	N/A	N/A	M	3.2E-07	kg/kg-day	5E-05	mg/kg-day	N/A	N/A	0.002
	Toxaphene	1.6	mg/kg	N/A	N/A	M	3.2E-07	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Pentachlorophenol	5.3	mg/kg	N/A	N/A	M	3.2E-07	kg/kg-day	3E-02	mg/kg-day	N/A	N/A	0.000056
Dermal	Arsenic	8	mg/kg	N/A	N/A	M	3.9E-07	kg/kg-day	3E-04	mg/kg-day	N/A	N/A	0.011
	Aldrin	0.011	mg/kg	N/A	N/A	M	1.3E-07	kg/kg-day	1.5E-05	mg/kg-day	N/A	N/A	0.00094
	Dieldrin	0.25	mg/kg	N/A	N/A	M	1.3E-06	kg/kg-day	2.5E-05	mg/kg-day	N/A	N/A	0.013
	Toxaphene	1.6	mg/kg	N/A	N/A	M	1.3E-06	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Pentachlorophenol	5.3	mg/kg	N/A	N/A	M	1.3E-06	kg/kg-day	1.5E-02	mg/kg-day	N/A	N/A	0.0005
												Total Hazard Index Across All Exposure Routes/Pathways	<1

See Table 53 for definitions, sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Media-specific concentration
mg/cu. M = milligrams per cubic meter

TABLE 69B
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Sediment
Exposure Medium:	Sediment
Exposure Point:	Site 3
Receptor Population	Trespasser
Receptor Age:	Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Arsenic	8.36	mg/kg	N/A	N/A	M	4.5E-08	kg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	5.67E-07
	Aldrin	0.011	mg/kg	N/A	N/A	M	4.5E-08	kg/kg-day	1.7E+01	$(mg/kg\text{-}day)^{-1}$	8.46E-09
	Dieldrin	0.25	mg/kg	N/A	N/A	M	4.5E-08	kg/kg-day	1.6E+01	$(mg/kg\text{-}day)^{-1}$	1.81E-07
	Toxaphene	1.6	mg/kg	N/A	N/A	M	4.5E-08	kg/kg-day	1.1E+00	$(mg/kg\text{-}day)^{-1}$	7.96E-08
	Pentachlorophenol	5.3	mg/kg	N/A	N/A	M	4.5E-08	kg/kg-day	1.2E-01	$(mg/kg\text{-}day)^{-1}$	2.88E-08
Dermal	Arsenic	8	mg/kg	N/A	N/A	M	0.0E+00	kg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	0.00E+00
	Aldrin	0.011	mg/kg	N/A	N/A	M	1.9E-08	kg/kg-day	3.4E+01	$(mg/kg\text{-}day)^{-1}$	6.94E-09
	Dieldrin	0.25	mg/kg	N/A	N/A	M	1.9E-07	kg/kg-day	3.2E+01	$(mg/kg\text{-}day)^{-1}$	1.48E-06
	Toxaphene	1.6	mg/kg	N/A	N/A	M	1.9E-07	kg/kg-day	2.2E+00	$(mg/kg\text{-}day)^{-1}$	6.53E-07
	Pentachlorophenol	5.3	mg/kg	N/A	N/A	M	1.9E-07	kg/kg-day	2.4E-01	$(mg/kg\text{-}day)^{-1}$	2.36E-07
											3E-06

See Table 53 for definitions, sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Medium-specific concentration
ND = No data available

TABLE 69C
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Receptor Population: Trespasser
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient			
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Ingestion	Inhalation	Dermal	Exposure Routes Total
Sediment	Sediment	Site 3	Arsenic	6E-07	N/A	0E+00	6E-07	Arsenic	0.0088	N/A	0.01	0.020
			Aldrin	8E-09	N/A	7E-09	2E-08	Aldrin	0.000069	N/A	0.0009	0.00101
			Dieldrin	2E-07	N/A	1E-06	2E-06	Dieldrin	0.0020	N/A	0.0130	0.02
			Toxaphene	8E-08	N/A	7E-07	7E-07	Toxaphene	N/A	N/A	N/A	N/A
			Pentachlorophenol	3E-08	N/A	2E-07	3E-07	Pentachlorophenol	0.000056	N/A	0.00046	0.00051
						Total Risk Across[Soil]	N/A	Total Hazard Index Across All Media and All Exposure Routes				<1
						Total Risk Across All Media and All Exposure Routes	3E-06					

N/A = Not Applicable

TABLE 70A
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Surface and Subsurface Soil
Exposure Point:	Site 4 Subsurface Soil
Receptor Population:	Construction Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Arsenic	6.1	mg/kg	N/A	N/A	M	1.13E-06	kg/kg-day	3E-04	mg/kg-day	N/A	N/A	0.023
	Dieldrin	0.037	mg/kg	N/A	N/A	M	1.13E-06	kg/kg-day	5E-05	mg/kg-day	N/A	N/A	0.00083
	3,4- Dichloroaniline	12000	mg/kg	N/A	N/A	M	1.13E-06	kg/kg-day	4E-03	mg/kg-day	N/A	N/A	3.4
	Dinoseb	1100	mg/kg	N/A	N/A	M	1.13E-06	kg/kg-day	1E-03	mg/kg-day	N/A	N/A	1.2
	1,2-Dichloroethane	0.34	mg/kg	N/A	N/A	M	1.13E-06	kg/kg-day	3E-02	mg/kg-day	N/A	N/A	N/A
Inhalation	Arsenic	6.1	mg/kg	N/A	N/A	M	3.56E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Dieldrin	0.037	mg/kg	N/A	N/A	M	3.56E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	3,4- Dichloroaniline	12000	mg/kg	N/A	N/A	M	3.56E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Dinoseb	1100	mg/kg	N/A	N/A	M	3.56E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	1,2-Dichloroethane	0.34	mg/kg	N/A	N/A	M	2.24E-05	kg/kg-day	1.4E-03	mg/kg-day	N/A	N/A	0.00535
Dermal	Arsenic	6.1	mg/kg	N/A	N/A	M	2.89E-07	kg/kg-day	3E-04	mg/kg-day	N/A	N/A	0.0059
	Dieldrin	0.037	mg/kg	N/A	N/A	M	9.63E-07	kg/kg-day	2.5E-05	mg/kg-day	N/A	N/A	0.0014
	3,4- Dichloroaniline	12000	mg/kg	N/A	N/A	M	9.63E-07	kg/kg-day	2E-03	mg/kg-day	N/A	N/A	5.8
	Dinoseb	1100	mg/kg	N/A	N/A	M	9.63E-07	kg/kg-day	5E-04	mg/kg-day	N/A	N/A	2.1
	1,2-Dichloroethane	0.34	mg/kg	N/A	N/A	M	9.63E-07	kg/kg-day	2.4E-02	mg/kg-day	N/A	N/A	0.0000
Total Hazard Index Across All Exposure Routes/Pathways													13

See Table 35 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Media-specific concentration
mg/cu. M = milligrams per cubic meter

TABLE 70B
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Surface and Subsurface Soil
Exposure Point:	Site 4 Subsurface Soil
Receptor Population:	Construction Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Arsenic	6.11	mg/kg	N/A	N/A	M	1.61E-08	kg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	1.48E-07
	Dieldrin	0.037	mg/kg	N/A	N/A	M	1.61E-08	kg/kg-day	1.6E+01	$(mg/kg\text{-}day)^{-1}$	9.52E-09
	3,4-Dichloroaniline	12000	mg/kg	N/A	N/A	M	1.61E-08	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Dinoseb	1100	mg/kg	N/A	N/A	M	1.61E-08	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	1,2-Dichloroethane	0.34	mg/kg	N/A	N/A	M	1.61E-08	kg/kg-day	9.1E-02	$(mg/kg\text{-}day)^{-1}$	4.91E-10
Inhalation	Arsenic	6.1	mg/kg	N/A	N/A	M	5.08E-13	kg/kg-day	1.51E+01	$(mg/kg\text{-}day)^{-1}$	4.67E-11
	Dieldrin	0.037	mg/kg	N/A	N/A	M	5.08E-13	kg/kg-day	1.6E+01	$(mg/kg\text{-}day)^{-1}$	3.01E-13
	3,4-Dichloroaniline	12000	mg/kg	N/A	N/A	M	5.08E-13	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Dinoseb	1100	mg/kg	N/A	N/A	M	5.08E-13	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	1,2-Dichloroethane	0.34	mg/kg	N/A	N/A	M	3.20E-07	kg/kg-day	9.1E-02	$(mg/kg\text{-}day)^{-1}$	9.74E-09
Dermal	Arsenic	6.1	mg/kg	N/A	N/A	M	4.13E-09	kg/kg-day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	3.78E-08
	Dieldrin	0.037	mg/kg	N/A	N/A	M	1.38E-08	kg/kg-day	3.2E+01	$(mg/kg\text{-}day)^{-1}$	1.63E-08
	3,4-Dichloroaniline	12000	mg/kg	N/A	N/A	M	1.38E-08	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Dinoseb	1100	mg/kg	N/A	N/A	M	1.38E-08	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	1,2-Dichloroethane	0.34	mg/kg	N/A	N/A	M	1.38E-08	kg/kg-day	1.1E-01	$(mg/kg\text{-}day)^{-1}$	5.24E-10
										Total Risk Across All Exposure Routes/Pathways	2.2E-07

See Table 35 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Medium-specific concentration

TABLE 70C
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient			
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface and Subsurface Soil	Site 4	Arsenic	1.5E-07	4.7E-11	3.8E-08	2E-07	Arsenic	0.023	N/A	0.006	0.03
			Dieldrin	9.5E-09	3.0E-13	1.6E-08	3E-08	Dieldrin	0.001	N/A	0.001	0.002
			3,4-Dichloroaniline	N/A	N/A	N/A	N/A	3,4- Dichloroaniline	3.4	N/A	5.8	9.2
			Dinoseb	N/A	N/A	N/A	N/A	Dinoseb	1.2	N/A	2.1	3.30
			1,2-Dichloroethane	4.9E-10	9.7E-09	5.2E-10	1E-08	1,2-Dichloroethane	N/A	0.005	0.000	0.005
						Total Risk Across[Soil]	2E-07	otal Hazard Index Across All Media and All Exposure Routes				13
						Total Risk Across All Media and All Exposure Routes	2E-07					

TABLE 71A
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 4 Surface Soil
Receptor Population:	Adult Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Dieldrin	0.46	mg/kg	N/A	N/A	M	4.89E-07	kg/kg-day	5E-05	mg/kg-day	N/A	N/A	0.00445
	Dinoseb	248	mg/kg	N/A	N/A	M	4.89E-07	kg/kg-day	1E-03	mg/kg-day	N/A	N/A	0.05
Inhalation	Dieldrin	0.46	mg/kg	N/A	N/A	M	1.48E-10	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Dinoseb	248	mg/kg	N/A	N/A	M	1.48E-10	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
Dermal	Dieldrin	0.46	mg/kg	N/A	N/A	M	4.01E-06	kg/kg-day	2.5E-05	mg/kg-day	N/A	N/A	0.073
	Dinoseb	248	mg/kg	N/A	N/A	M	4.01E-06	kg/kg-day	5E-04	mg/kg-day	N/A	N/A	0.747
Total Hazard Index Across All Exposure Routes/Pathways													<1

See Table 45 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Media-specific concentration
mg/cu. M = milligram per cubic meter

TABLE 71B
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 4 Surface Soil
Receptor Population:	Adult Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Dieldrin	0.46	mg/kg	N/A	N/A	M	1.75E-07	kg/kg-day	1.60E+01	$(mg/kg\text{-}day)^{-1}$	1.27E-06
	Dinoseb	248	mg/kg	N/A	N/A	M	1.75E-07	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
Inhalation	Dieldrin	0.46	mg/kg	N/A	N/A	M	5.29E-11	kg/kg-day	1.60E+01	$(mg/kg\text{-}day)^{-1}$	3.85E-10
	Dinoseb	248	mg/kg	N/A	N/A	M	5.29E-11	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
Dermal	Dieldrin	0.46	mg/kg	N/A	N/A	M	1.43E-06	kg/kg-day	3.20E+01	$(mg/kg\text{-}day)^{-1}$	2.09E-05
	Dinoseb	248	mg/kg	N/A	N/A	M	1.43E-06	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
										Total Risk Across All Exposure Routes/Pathways	2.2E-05

See Table 45 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Medium-specific concentration
ND = No data available

TABLE 71C
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Receptor Population: Adult Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient			
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Site 4	Dieldrin	1E-06	1E-10	8E-06	8E-06	Dieldrin	0.00003	N/A	0.03	0.03
			Dinoseb	N/A	N/A	N/A	N/A	Dinoseb	0.05	N/A	1	1
						Total Risk Across[Soil]	8E-06				Total Hazard Index Across All Media and All Exposure Routes	<1
						Total Risk Across All Media and All Exposure Routes	8E-06					

N/A = Not Applicable

TABLE 72A
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 4 Surface Soil
Receptor Population:	Trespasser
Receptor Age:	Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Dieldrin	0.46	mg/kg	N/A	N/A	M	1.58E-07	kg/kg-day	5E-05	mg/kg-day	N/A	N/A	0.0014
	Dinoseb	248	mg/kg	N/A	N/A	M	1.58E-07	kg/kg-day	1E-03	mg/kg-day	N/A	N/A	0.039
Inhalation	Dieldrin	0.46	mg/kg	N/A	N/A	M	4.80E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Dinoseb	248	mg/kg	N/A	N/A	M	4.80E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
Dermal	Dieldrin	0.46	mg/kg	N/A	N/A	M	1.30E-06	kg/kg-day	2.5E-05	mg/kg-day	N/A	N/A	0.024
	Dinoseb	248	mg/kg	N/A	N/A	M	1.30E-06	kg/kg-day	5E-04	mg/kg-day	N/A	N/A	0.645
Total Hazard Index Across All Exposure Routes/Pathways													<1

See Table 49 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Media-specific concentration
mg/cu. M = milligrams per cubic meter

TABLE 72B
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 4 Surface Soil
Receptor Population:	Trespasser
Receptor Age:	Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Dieldrin	0.46	mg/kg	N/A	N/A	M	2.26E-08	kg/kg-day	1.60E+01	$(mg/kg\text{-}day)^{-1}$	1.65E-07
	Dinoseb	248	mg/kg	N/A	N/A	M	2.26E-08	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
Inhalation	Dieldrin	0.46	mg/kg	N/A	N/A	M	6.85E-12	kg/kg-day	1.60E+01	$(mg/kg\text{-}day)^{-1}$	4.99E-11
	Dinoseb	248	mg/kg	N/A	N/A	M	6.85E-12	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
Dermal	Dieldrin	0.46	mg/kg	N/A	N/A	M	1.85E-07	kg/kg-day	3.20E+01	$(mg/kg\text{-}day)^{-1}$	2.70E-06
	Dinoseb	248	mg/kg	N/A	N/A	M	1.85E-07	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
										Total Risk Across All Exposure Routes/Pathways	2.9E-06

See Table 49 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Medium-specific concentration
ND = No data available

TABLE 72C
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Receptor Population: Trespasser/Visitor
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient			
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Site 4	Dieldrin	2E-07	5E-11	3E-06	3E-06	Dieldrin	0.0014	N/A	0.024	0.0251
			Dinoseb	N/A	N/A	N/A		Dinoseb	0.039	N/A	0.64	0.684
						Total Risk Across[Soil]	3E-06	Total Hazard Index Across All Media and All Exposure Routes				<1
						Total Risk Across All Media and All Exposure Routes	3E-06					

N/A = Not Applicable

TABLE 73A
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 6 Surface Soil
Receptor Population:	Construction Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Aldrin	0.017	mg/kg	N/A	N/A	M	1.13E-06	kg/kg-day	3E-05	mg/kg-day	N/A	N/A	0.0007
	Dieldrin	0.031	mg/kg	N/A	N/A	M	1.13E-06	kg/kg-day	5E-05	mg/kg-day	N/A	N/A	0.001
	Methoxychlor	20.06	mg/kg	N/A	N/A	M	1.13E-06	kg/kg-day	5E-03	mg/kg-day	N/A	N/A	0.005
	Toxaphene	0.78	mg/kg	N/A	N/A	M	1.13E-06	kg/kg-day	ND	mg/kg-day	N/A	N/A	N/A
	Dinoseb	37.97	mg/kg	N/A	N/A	M	1.13E-06	kg/kg-day	1E-03	mg/kg-day	N/A	N/A	0.043
Inhalation	Aldrin	0.017	mg/kg	N/A	N/A	M	3.56E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Dieldrin	0.031	mg/kg	N/A	N/A	M	3.56E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Methoxychlor	20.06	mg/kg	N/A	N/A	M	3.56E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Toxaphene	0.78	mg/kg	N/A	N/A	M	3.56E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Dinoseb	37.97	mg/kg	N/A	N/A	M	3.56E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
Dermal	Aldrin	0.017	mg/kg	N/A	N/A	M	9.63E-07	kg/kg-day	1.5E-05	mg/kg-day	N/A	N/A	0.0011
	Dieldrin	0.031	mg/kg	N/A	N/A	M	9.63E-07	kg/kg-day	2.5E-05	mg/kg-day	N/A	N/A	0.001
	Methoxychlor	20.06	mg/kg	N/A	N/A	M	9.63E-07	kg/kg-day	2.5E-03	mg/kg-day	N/A	N/A	0.008
	Toxaphene	0.78	mg/kg	N/A	N/A	M	9.63E-07	kg/kg-day	ND	mg/kg-day	N/A	N/A	N/A
	Dinoseb	37.97	mg/kg	N/A	N/A	M	9.63E-07	kg/kg-day	5E-04	mg/kg-day	N/A	N/A	0.073
												Total Hazard Index Across All Exposure Routes/Pathways	<1

See Table 35 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Media-specific concentration
mg/cu. M = milligrams per cubic meter

TABLE 73B
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 6 Surface Soil
Receptor Population:	Construction Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Aldrin	0.017	mg/kg	N/A	N/A	M	1.61E-08	kg/kg-day	1.7E+01	$(mg/kg\text{-}day)^{-1}$	4.78E-09
	Dieldrin	0.031	mg/kg	N/A	N/A	M	1.61E-08	kg/kg-day	1.6E+01	$(mg/kg\text{-}day)^{-1}$	7.91E-09
	Methoxychlor	20.06	mg/kg	N/A	N/A	M	1.61E-08	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Toxaphene	0.78	mg/kg	N/A	N/A	M	1.61E-08	kg/kg-day	1.1E+00	$(mg/kg\text{-}day)^{-1}$	1.38E-08
	Dinoseb	37.97	mg/kg	N/A	N/A	M	1.61E-08	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
Inhalation	Aldrin	0.017	mg/kg	N/A	N/A	M	5.08E-13	kg/kg-day	1.7E+01	$(mg/kg\text{-}day)^{-1}$	1.52E-13
	Dieldrin	0.031	mg/kg	N/A	N/A	M	5.08E-13	kg/kg-day	1.6E+01	$(mg/kg\text{-}day)^{-1}$	2.50E-13
	Methoxychlor	20.06	mg/kg	N/A	N/A	M	5.08E-13	kg/kg-day	ND	$(mg/kg\text{-}day)^{-1}$	N/A
	Toxaphene	0.78	mg/kg	N/A	N/A	M	5.08E-13	kg/kg-day	1.1E+00	$(mg/kg\text{-}day)^{-1}$	4.43E-13
	Dinoseb	37.97	mg/kg	N/A	N/A	M	5.08E-13	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
Dermal	Aldrin	0.017	mg/kg	N/A	N/A	M	1.38E-08	kg/kg-day	3.4E+01	$(mg/kg\text{-}day)^{-1}$	8.16E-09
	Dieldrin	0.031	mg/kg	N/A	N/A	M	1.38E-08	kg/kg-day	3.2E+01	$(mg/kg\text{-}day)^{-1}$	1.35E-08
	Methoxychlor	20.06	mg/kg	N/A	N/A	M	1.38E-08	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Toxaphene	0.78	mg/kg	N/A	N/A	M	1.38E-08	kg/kg-day	2.2E+00	$(mg/kg\text{-}day)^{-1}$	2.35E-08
	Dinoseb	37.97	mg/kg	N/A	N/A	M	1.38E-08	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
										Total Risk Across All Exposure Routes/Pathways	7E-08

See Table 35 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Medium-specific concentration
ND = No data available

TABLE 73C
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient			
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Site 6	Aldrin	5E-09	2E-13	8E-09	1E-08	Aldrin	0.00069	N/A	0.001	0.0018
			Dieldrin	8E-09	2E-13	1E-08	2E-08	Dieldrin	0.00069	N/A	0.001	0.0019
			Methoxychlor	N/A	N/A	N/A	N/A	Methoxychlor	0.005	N/A	0.008	0.012
			Toxaphene	1E-08	4E-13	4E-08	4E-08	Toxaphene	N/A	N/A	N/A	N/A
			Dinoseb	N/A	N/A	N/A	N/A	Dinoseb	0.043	N/A	0.0731	0.116
						Total Risk Across[Soil]	7E-08	Total Hazard Index Across All Media and All Exposure Routes				<1
						Total Risk Across All Media and All Exposure Routes	7E-08					

N/A = Not Applicable

TABLE 74A
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 6 Surface Soil
Receptor Population:	Adult Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Aldrin	0.017	mg/kg	N/A	N/A	M	4.89E-07	kg/kg-day	3E-05	mg/kg-day	N/A	N/A	0.00028
	Dieldrin	0.031	mg/kg	N/A	N/A	M	4.89E-07	kg/kg-day	5E-05	mg/kg-day	N/A	N/A	0.0003
	Methoxychlor	20.06	mg/kg	N/A	N/A	M	4.89E-07	kg/kg-day	5E-03	mg/kg-day	N/A	N/A	0.00196
	Toxaphene	0.78	mg/kg	N/A	N/A	M	4.89E-07	kg/kg-day	ND	mg/kg-day	N/A	N/A	N/A
	Dinoseb	37.97	mg/kg	N/A	N/A	M	4.89E-07	kg/kg-day	1E-03	mg/kg-day	N/A	N/A	0.019
Inhalation	Aldrin	0.017	mg/kg	N/A	N/A	M	1.48E-10	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Dieldrin	0.031	mg/kg	N/A	N/A	M	1.48E-10	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Methoxychlor	20.06	mg/kg	N/A	N/A	M	1.48E-10	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Toxaphene	0.78	mg/kg	N/A	N/A	M	1.48E-10	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Dinoseb	37.97	mg/kg	N/A	N/A	M	1.48E-10	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
Dermal	Aldrin	0.017	mg/kg	N/A	N/A	M	4.01E-06	kg/kg-day	1.5E-05	mg/kg-day	N/A	N/A	0.00467
	Dieldrin	0.031	mg/kg	N/A	N/A	M	4.01E-06	kg/kg-day	2.5E-05	mg/kg-day	N/A	N/A	0.0049
	Methoxychlor	20.06	mg/kg	N/A	N/A	M	4.01E-06	kg/kg-day	2.5E-03	mg/kg-day	N/A	N/A	0.032
	Toxaphene	0.78	mg/kg	N/A	N/A	M	4.01E-06	kg/kg-day	ND	mg/kg-day	N/A	N/A	N/A
	Dinoseb	37.97	mg/kg	N/A	N/A	M	4.01E-06	kg/kg-day	5E-04	mg/kg-day	N/A	N/A	0.3
Total Hazard Index Across All Exposure Routes/Pathways													<1

See Table 45 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Media-specific concentration
mg/cu. M = milligrams per cubic meter

TABLE 74B
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 6 Surface Soil
Receptor Population:	Adult Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Aldrin	0.017	mg/kg	N/A	N/A	M	1.75E-07	kg/kg-day	1.70E+01	$(mg/kg\text{-}day)^{-1}$	5.18E-08
	Dieldrin	0.031	mg/kg	N/A	N/A	M	1.75E-07	kg/kg-day	1.60E+01	$(mg/kg\text{-}day)^{-1}$	8.58E-08
	Methoxychlor	20.06	mg/kg	N/A	N/A	M	1.75E-07	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Toxaphene	0.78	mg/kg	N/A	N/A	M	1.75E-07	kg/kg-day	1.10E+00	$(mg/kg\text{-}day)^{-1}$	1.49E-07
	Dinoseb	37.97	mg/kg	N/A	N/A	M	1.75E-07	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
Inhalation	Aldrin	0.017	mg/kg	N/A	N/A	M	5.29E-11	kg/kg-day	1.7E+01	$(mg/kg\text{-}day)^{-1}$	1.58E-11
	Dieldrin	0.031	mg/kg	N/A	N/A	M	5.29E-11	kg/kg-day	1.6E+01	$(mg/kg\text{-}day)^{-1}$	2.60E-11
	Methoxychlor	20.06	mg/kg	N/A	N/A	M	5.29E-11	kg/kg-day	ND	$(mg/kg\text{-}day)^{-1}$	N/A
	Toxaphene	0.78	mg/kg	N/A	N/A	M	5.29E-11	kg/kg-day	1.1E+00	$(mg/kg\text{-}day)^{-1}$	4.61E-11
	Dinoseb	37.97	mg/kg	N/A	N/A	M	5.29E-11	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
Dermal	Aldrin	0.017	mg/kg	N/A	N/A	M	1.43E-06	kg/kg-day	3.4E+01	$(mg/kg\text{-}day)^{-1}$	8.50E-07
	Dieldrin	0.031	mg/kg	N/A	N/A	M	1.43E-06	kg/kg-day	3.2E+01	$(mg/kg\text{-}day)^{-1}$	1.41E-06
	Methoxychlor	20.06	mg/kg	N/A	N/A	M	1.43E-06	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Toxaphene	0.78	mg/kg	N/A	N/A	M	1.43E-06	kg/kg-day	2.2E+00	$(mg/kg\text{-}day)^{-1}$	2.45E-06
	Dinoseb	37.97	mg/kg	N/A	N/A	M	1.43E-06	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
										Total Risk Across All Exposure Routes/Pathways	5E-06

See Table 45 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Medium-specific concentration
ND = No data available

TABLE 74C
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Receptor Population: Adult Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient			
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Site 6	Aldrin	5E-08	2E-11	9E-07	9E-07	Aldrin	0.00028	N/A	0.0047	0.005
			Dieldrin	9E-08	3E-11	1E-06	1E-06	Dieldrin	0.0003	N/A	0.0049	0.0052
			Methoxychlor	N/A	N/A	N/A	N/A	Methoxychlor	0.00196	N/A	0.032	0.034
			Toxaphene	1E-07	5E-11	2E-06	3E-06	Toxaphene	N/A	N/A	N/A	N/A
			Dinoseb	N/A	N/A	N/A	N/A	Dinoseb	0.019	N/A	0.3047	0.323
						Total Risk Across[Soil]	5E-06	Total Hazard Index Across All Media and All Exposure Routes				<1
						Total Risk Across All Media and All Exposure Routes	5E-06					

N/A = Not Applicable

TABLE 75A
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 6 Surface Soil
Receptor Population:	Trespasser
Receptor Age:	Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Aldrin	0.017	mg/kg	N/A	N/A	M	1.58E-07	kg/kg-day	3E-05	mg/kg-day	N/A	N/A	0.00009
	Dieldrin	0.031	mg/kg	N/A	N/A	M	1.58E-07	kg/kg-day	5E-05	mg/kg-day	N/A	N/A	0.000
	Methoxychlor	20.06	mg/kg	N/A	N/A	M	1.58E-07	kg/kg-day	5E-03	mg/kg-day	N/A	N/A	0.001
	Toxaphene	0.78	mg/kg	N/A	N/A	M	1.58E-07	kg/kg-day	ND	mg/kg-day	N/A	N/A	N/A
	Dinoseb	37.97	mg/kg	N/A	N/A	M	1.58E-07	kg/kg-day	1E-03	mg/kg-day	N/A	N/A	0.006
Inhalation	Aldrin	0.017	mg/kg	N/A	N/A	M	4.80E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Dieldrin	0.031	mg/kg	N/A	N/A	M	4.80E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Methoxychlor	20.06	mg/kg	N/A	N/A	M	4.80E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Toxaphene	0.78	mg/kg	N/A	N/A	M	4.80E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Dinoseb	37.97	mg/kg	N/A	N/A	M	4.80E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
Dermal	Aldrin	0.017	mg/kg	N/A	N/A	M	1.30E-06	kg/kg-day	1.5E-05	mg/kg-day	N/A	N/A	0.00151
	Dieldrin	0.031	mg/kg	N/A	N/A	M	1.30E-06	kg/kg-day	2.5E-05	mg/kg-day	N/A	N/A	0.002
	Methoxychlor	20.06	mg/kg	N/A	N/A	M	1.30E-06	kg/kg-day	2.5E-03	mg/kg-day	N/A	N/A	0.010
	Toxaphene	0.78	mg/kg	N/A	N/A	M	1.30E-06	kg/kg-day	ND	mg/kg-day	N/A	N/A	N/A
	Dinoseb	37.97	mg/kg	N/A	N/A	M	1.30E-06	kg/kg-day	5E-04	mg/kg-day	N/A	N/A	0.099
												Total Hazard Index Across All Exposure Routes/Pathways	<1

See Table 49 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Media-specific concentration
mg/cu. M = milligrams per cubic meter

TABLE 75B
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 6 Surface Soil
Receptor Population:	Trespasser
Receptor Age:	Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Aldrin	0.017	mg/kg	N/A	N/A	M	2.26E-08	kg/kg-day	1.7E+01	$(mg/kg\text{-}day)^{-1}$	6.71E-09
	Dieldrin	0.031	mg/kg	N/A	N/A	M	2.26E-08	kg/kg-day	1.6E+01	$(mg/kg\text{-}day)^{-1}$	1.11E-08
	Methoxychlor	20.06	mg/kg	N/A	N/A	M	2.26E-08	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Toxaphene	0.78	mg/kg	N/A	N/A	M	2.26E-08	kg/kg-day	1.1E+00	$(mg/kg\text{-}day)^{-1}$	1.93E-08
	Dinoseb	37.97	mg/kg	N/A	N/A	M	2.26E-08	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
Inhalation	Aldrin	0.017	mg/kg	N/A	N/A	M	6.85E-12	kg/kg-day	1.72E+01	$(mg/kg\text{-}day)^{-1}$	1.32E-12
	Dieldrin	0.031	mg/kg	N/A	N/A	M	6.85E-12	kg/kg-day	1.6E+01	$(mg/kg\text{-}day)^{-1}$	2.16E-12
	Methoxychlor	20.06	mg/kg	N/A	N/A	M	6.85E-12	kg/kg-day	ND	$(mg/kg\text{-}day)^{-1}$	N/A
	Toxaphene	0.78	mg/kg	N/A	N/A	M	6.85E-12	kg/kg-day	1.12E+00	$(mg/kg\text{-}day)^{-1}$	3.84E-12
	Dinoseb	37.97	mg/kg	N/A	N/A	M	6.85E-12	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
Dermal	Aldrin	0.017	mg/kg	N/A	N/A	M	1.85E-07	kg/kg-day	3.4E+01	$(mg/kg\text{-}day)^{-1}$	1.10E-07
	Dieldrin	0.031	mg/kg	N/A	N/A	M	1.85E-07	kg/kg-day	3.2E+01	$(mg/kg\text{-}day)^{-1}$	1.82E-07
	Methoxychlor	20.06	mg/kg	N/A	N/A	M	1.85E-07	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Toxaphene	0.78	mg/kg	N/A	N/A	M	1.85E-07	kg/kg-day	2.2E+00	$(mg/kg\text{-}day)^{-1}$	3.17E-07
	Dinoseb	37.97	mg/kg	N/A	N/A	M	1.85E-07	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
										Total Risk Across All Exposure Routes/Pathways	6E-07

See Table 49 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Medium-specific concentration
ND = No data available

TABLE 75C
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Receptor Population: Trespasser
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient			
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Site 6	Aldrin	7E-09	1E-12	1E-07	1E-07	Aldrin	0.0001	N/A	0.0015	0.002
			Dieldrin	1E-08	2E-12	2E-07	2E-07	Dieldrin	0.00010	N/A	0.002	0.0017
			Methoxychlor	N/A	N/A	N/A	N/A	Methoxychlor	0.001	N/A	0.010	0.011
			Toxaphene	2E-08	4E-12	3E-07	3E-07	Toxaphene	N/A	N/A	N/A	N/A
			Dinoseb	N/A	N/A	N/A	N/A	Dinoseb	0.006	N/A	0.0986	0.105
						Total Risk Across[Soil]	6E-07	Total Hazard Index Across All Media and All Exposure Routes				<1
						Total Risk Across All Media and All Exposure Routes	6E-07					

N/A = Not Applicable

TABLE 76A
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Subsurface Soil
Exposure Point:	Site 9 Subsurface Soil
Receptor Population:	Construction Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Arsenic	7.3	mg/kg	N/A	N/A	M	1.13E-06	kg/kg-day	3.00E-04	mg/kg-day	N/A	N/A	0.027
	3,4-Dichloroaniline	450	mg/kg	N/A	N/A	M	1.13E-06	kg/kg-day	4.00E-03	mg/kg-day	N/A	N/A	0.130
	Dinoseb	29000	mg/kg	N/A	N/A	M	1.13E-06	kg/kg-day	1.00E-03	mg/kg-day	N/A	N/A	33
	Propanil	4000	mg/kg	N/A	N/A	M	1.13E-06	kg/kg-day	5.00E-03	mg/kg-day	N/A	N/A	0.9
Inhalation	Arsenic	7.3	mg/kg	N/A	N/A	M	3.56E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	3,4-Dichloroaniline	450	mg/kg	N/A	N/A	M	3.56E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Dinoseb	29000	mg/kg	N/A	N/A	M	3.56E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Propanil	4000	mg/kg	N/A	N/A	M	3.56E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
Dermal	Arsenic	7.3	mg/kg	N/A	N/A	M	2.89E-07	kg/kg-day	3.00E-04	mg/kg-day	N/A	N/A	0.007
	3,4-Dichloroaniline	450	mg/kg	N/A	N/A	M	9.63E-07	kg/kg-day	2.00E-03	mg/kg-day	N/A	N/A	0.22
	Dinoseb	29000	mg/kg	N/A	N/A	M	9.63E-07	kg/kg-day	5.00E-04	mg/kg-day	N/A	N/A	56
	Propanil	4000	mg/kg	N/A	N/A	M	9.63E-07	kg/kg-day	2.50E-03	mg/kg-day	N/A	N/A	1.5
												Total Hazard Index Across All Exposure Routes/Pathways	91

See Table 35 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Media-specific concentration

TABLE 76B
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Subsurface Soil
Exposure Point:	Site 9 Subsurface Soil
Receptor Population:	Construction Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Arsenic	7.3	mg/kg	N/A	N/A	M	1.61E-08	kg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	1.76E-07
	3,4-Dichloroaniline	450	mg/kg	N/A	N/A	M	1.61E-08	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Dinoseb	29000	mg/kg	N/A	N/A	M	1.61E-08	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Propanil	4000	mg/kg	N/A	N/A	M	1.61E-08	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
Inhalation	Arsenic	7.3	mg/kg	N/A	N/A	M	5.08E-13	kg/kg-day	1.51E+01	$(mg/kg\text{-}day)^{-1}$	5.58E-11
	3,4-Dichloroaniline	450	mg/kg	N/A	N/A	M	5.08E-13	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Dinoseb	29000	mg/kg	N/A	N/A	M	5.08E-13	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Propanil	4000	mg/kg	N/A	N/A	M	5.08E-13	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
Dermal	Arsenic	7.3	mg/kg	N/A	N/A	M	4.13E-09	kg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	4.52E-08
	3,4-Dichloroaniline	450		N/A	N/A	M	1.38E-08	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Dinoseb	29000	mg/kg	N/A	N/A	M	1.38E-08	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Propanil	4000	mg/kg	N/A	N/A	M	1.38E-08	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
										Total Risk Across All Exposure Routes/Pathways	2.2E-07

See Table 35 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Medium-specific concentration

TABLE 76C

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient			
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface and Subsurface Soil	Site 9	Arsenic	2E-07	6E-11	5E-08	2E-07	Arsenic	0.03	N/A	0.01	0.03
			3,4-Dichloroaniline	N/A	N/A	N/A	N/A	3,4-Dichloroaniline	0.13	N/A	0.22	0.35
			Dinoseb	N/A	N/A	N/A	N/A	Dinoseb	32.77	N/A	55.85	89
			Propanil	N/A	N/A	N/A	N/A	Propanil	0.90	N/A	1.54	2.44
						Total Risk Across[Soil]	2E-07	Total Hazard Index Across All Media and All Exposure Routes				91

TABLE 77A
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 9 Surface Soil
Receptor Population:	Adult Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Heptachlor	1.5	mg/kg	N/A	N/A	M	4.89E-07	kg/kg-day	5E-04	mg/kg-day	N/A	N/A	0.0015
	Dinoseb	29000	mg/kg	N/A	N/A	M	4.89E-07	kg/kg-day	1E-03	mg/kg-day	N/A	N/A	14.2
	Propanil	4000	mg/kg	N/A	N/A	M	4.89E-07	kg/kg-day	5E-03	mg/kg-day	N/A	N/A	0.391
Inhalation	Heptachlor	1.5	mg/kg	N/A	N/A	M	1.48E-10	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Dinoseb	29000	mg/kg	N/A	N/A	M	1.48E-10	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Propanil	4000	mg/kg	N/A	N/A	M	1.48E-10	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
Dermal	Heptachlor	1.5	mg/kg	N/A	N/A	M	4.01E-06	kg/kg-day	2.5E-04	mg/kg-day	N/A	N/A	0.024
	Dinoseb	29000	mg/kg	N/A	N/A	M	4.01E-06	kg/kg-day	5E-04	mg/kg-day	N/A	N/A	233
	Propanil	4000	mg/kg	N/A	N/A	M	4.01E-06	kg/kg-day	2.5E-03	mg/kg-day	N/A	N/A	6.4
Total Hazard Index Across All Exposure Routes/Pathways													254

See Table 45 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Media-specific concentration
mg/cu. M = milligrams per cubic meter

TABLE 77B
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 9 Surface Soil
Receptor Population:	Adult Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Heptachlor	1.5	mg/kg	N/A	N/A	M	1.75E-07	kg/kg-day	4.5E+00	$(mg/kg\text{-}day)^{-1}$	1.18E-06
	Dinoseb	29000	mg/kg	N/A	N/A	M	1.75E-07	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Propanil	4000	mg/kg	N/A	N/A	M	1.75E-07	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
Inhalation	Heptachlor	1.5	mg/kg	N/A	N/A	M	5.29E-11	kg/kg-day	4.55E+00	$(mg/kg\text{-}day)^{-1}$	3.61E-10
	Dinoseb	29000	mg/kg	N/A	N/A	M	5.29E-11	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Propanil	4000	mg/kg	N/A	N/A	M	5.29E-11	kg/kg-day	ND	$(mg/kg\text{-}day)^{-1}$	N/A
Dermal	Heptachlor	1.5	mg/kg	N/A	N/A	M	1.43E-06	kg/kg-day	9E+00	$(mg/kg\text{-}day)^{-1}$	1.93E-05
	Dinoseb	29000	mg/kg	N/A	N/A	M	1.43E-06	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Propanil	4000	mg/kg	N/A	N/A	M	1.43E-06	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
										Total Risk Across All Exposure Routes/Pathways	2.1E-05

See Table 45 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Medium-specific concentration
ND = No data available

TABLE 77C
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Receptor Population: Adult Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient			
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Site 9	Heptachlor	1.18E-06	3.61E-10	1.93E-05	2.05E-05	Heptachlor	0.0015	N/A	0.0241	0.026
Soil	Surface Soil	Site 9	Dinoseb	N/A	N/A	N/A	N/A	Dinoseb	14	N/A	233	247
			Propanil	N/A	N/A	N/A	N/A	Propanil	0.39	N/A	6	7
						Total Risk Across[Soil]	2E-05	Total Hazard Index Across All Media and All Exposure Routes				254
						Total Risk Across All Media and All Exposure Routes	2E-05					

N/A = Not Applicable

TABLE 78A
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 9 Surface Soil
Receptor Population:	Trespasser
Receptor Age:	Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Heptachlor	1.5	mg/kg	N/A	N/A	M	1.58E-07	kg/kg-day	5E-04	mg/kg-day	N/A	N/A	0.00047
	Dinoseb	29000	mg/kg	N/A	N/A	M	1.58E-07	kg/kg-day	1E-03	mg/kg-day	N/A	N/A	4.6
	Propanil	4000	mg/kg	N/A	N/A	M	1.58E-07	kg/kg-day	5E-03	mg/kg-day	N/A	N/A	0.127
Inhalation	Heptachlor	1.5	mg/kg	N/A	N/A	M	3.08E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Dinoseb	29000	mg/kg	N/A	N/A	M	3.08E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Propanil	4000	mg/kg	N/A	N/A	M	3.08E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
Dermal	Heptachlor	1.5	mg/kg	N/A	N/A	M	1.30E-06	kg/kg-day	2.5E-04	mg/kg-day	N/A	N/A	0.0078
	Dinoseb	29000	mg/kg	N/A	N/A	M	1.30E-06	kg/kg-day	5E-04	mg/kg-day	N/A	N/A	75.3
	Propanil	4000	mg/kg	N/A	N/A	M	1.30E-06	kg/kg-day	2.5E-03	mg/kg-day	N/A	N/A	2.1
Total Hazard Index Across All Exposure Routes/Pathways													82

See Table 49 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Media-specific concentration
mg/cu. M = milligrams per cubic meter

TABLE 78B
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 9 Surface Soil
Receptor Population:	Trespasser
Receptor Age:	Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Heptachlor	1.5	mg/kg	N/A	N/A	M	2.26E-08	kg/kg-day	4.5E+00	$(mg/kg\text{-}day)^{-1}$	1.5E-07
	Dinoseb	29000	mg/kg	N/A	N/A	M	2.26E-08	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Propanil	4000	mg/kg	N/A	N/A	M	2.26E-08	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
Inhalation	Heptachlor	1.5	mg/kg	N/A	N/A	M	4.41E-12	kg/kg-day	4.55E+00	$(mg/kg\text{-}day)^{-1}$	3.0E-11
	Dinoseb	29000	mg/kg	N/A	N/A	M	4.41E-12	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Propanil	4000	mg/kg	N/A	N/A	M	4.41E-12	kg/kg-day	ND	$(mg/kg\text{-}day)^{-1}$	N/A
Dermal	Heptachlor	1.5	mg/kg	N/A	N/A	M	1.85E-07	kg/kg-day	9E+00	$(mg/kg\text{-}day)^{-1}$	2.5E-06
	Dinoseb	29000	mg/kg	N/A	N/A	M	1.85E-07	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Propanil	4000	mg/kg	N/A	N/A	M	1.85E-07	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
										Total Risk Across All Exposure Routes/Pathways	2.7E-06

See Table 49 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Medium-specific concentration
ND = No data available

TABLE 78C
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Receptor Population: Trespasser
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient			
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Site 9	Heptachlor	1.53E-07	3.01E-11	2.50E-06	2.66E-06	Heptachlor	0.0005	N/A	0.0078	0.0083
			Dinoseb	N/A	N/A	N/A	N/A	Dinoseb	4.6	N/A	75.3	80
			Propanil	N/A	N/A	N/A	N/A	Propanil	0.127	N/A	2.1	2
						Total Risk Across[Soil]	3E-06	Total Hazard Index Across All Media and All Exposure Routes				82
						Total Risk Across All Media and All Exposure Routes	3E-06					

N/A = Not Applicable

TABLE 79A
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Groundwater
Exposure Medium:	Alluvial Groundwater
Exposure Point:	Alluvial Groundwater
Receptor Population:	Offsite Agricultural Workers
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation	1,1,2-Trichloroethane	0.027	mg/L	1.9E-02	mg/m^3	R	5.80E-03	mg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	1,2-Dichloroethane	**87**	**mg/L**	**2.9E+00**	mg/m^3	**R**	**5.80E-03**	**mg/kg-day**	**1.4E-03**	**mg/kg-day**	**N/A**	**N/A**	**11.8**
	1,2-Dichloropropane	0.043	mg/L	7.1E-02	mg/m^3	R	5.80E-03	mg/kg-day	1.1E-03	mg/kg-day	N/A	N/A	0.36
	4-Methyl-2-Pentanone (MIBK)	2.5	mg/L	2.8E-02	mg/m^3	R	5.80E-03	mg/kg-day	2.3E-02	mg/kg-day	N/A	N/A	0.007
	Acetone	2	mg/L	5.2E+00	mg/m^3	R	5.80E-03	mg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Benzene	0.046	mg/L	2.2E-01	mg/m^3	R	5.80E-03	mg/kg-day	1.7E-03	mg/kg-day	N/A	N/A	0.74
	Bromodichloromethane	0.006	mg/L	2.8E-02	mg/m^3	R	5.80E-03	mg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Bromoform	0.011	mg/L	1.3E-02	mg/m^3	R	5.80E-03	mg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Chlorobenzene	0.47	mg/L	4.8E-02	mg/m^3	R	5.80E-03	mg/kg-day	5.7E-03	mg/kg-day	N/A	N/A	0.048
	Chloroform	**1.40**	**mg/L**	**1.4E-01**	mg/m^3	**R**	**5.80E-03**	**mg/kg-day**	**8.6E-05**	**mg/kg-day**	**N/A**	**N/A**	**9.7**
	Dibromochloromethane	0.013	mg/L	1.4E-04	mg/m^3	R	5.80E-03	mg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Methylene chloride	5	mg/L	4.4E+01	mg/m^3	R	5.80E-03	mg/kg-day	8.6E-01	mg/kg-day	N/A	N/A	0.3
	Toluene	**140**	**mg/L**	**2.8E+01**	mg/m^3	**R**	**5.80E-03**	**mg/kg-day**	**1.14E-01**	**mg/kg-day**	**N/A**	**N/A**	**1.4**
												Total Hazard Index Across All Exposure Routes/Pathways	24

See Table 56 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
R = Route-specific concentration
$\mu g/m^3$ = micrograms per cubic meter

TABLE 79B
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Groundwater
Exposure Medium:	Alluvial Groundwater
Exposure Point:	Alluvial Groundwater
Receptor Population:	Offsite Agricultural Workers
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation	**1,1,2-Trichloroethane**	**0.027**	**mg/L**	**1.9E-02**	**mg/m^3**	**R**	**2.07E-03**	**mg/kg-day**	**5.6E-02**	**$(mg/kg\text{-}day)^{-1}$**	**2.2E-06**
	1,2-Dichloroethane	**87**	**mg/L**	**2.9E+00**	mg/m^3	**R**	**2.07E-03**	**mg/kg-day**	**9.1E-02**	**$(mg/kg\text{-}day)^{-1}$**	**5.4E-04**
	1,2-Dichloropropane	0.043	mg/L	7.1E-02	mg/m^3	R	2.07E-03	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	4-Methyl-2-Pentanone (MIBK)	2.5	mg/L	2.8E-02	mg/m^3	R	2.07E-03	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Acetone	2	mg/L	5.2E+00	mg/m^3	R	2.07E-03	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Benzene	**0.046**	**mg/L**	**2.2E-01**	mg/m^3	**R**	**2.07E-03**	**mg/kg-day**	**2.9E-02**	**$(mg/kg\text{-}day)^{-1}$**	**1.3E-05**
	Bromodichloromethane	0.0061	mg/L	2.8E-02	mg/m^3	R	2.07E-03	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Bromoform	0.011	mg/L	1.3E-02	mg/m^3	R	2.07E-03	mg/kg-day	3.9E-03	$(mg/kg\text{-}day)^{-1}$	1.0E-07
	Chlorobenzene	0.47	mg/L	4.8E-02	mg/m^3	R	2.07E-03	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Chloroform	**1.4**	**mg/L**	**1.4E-01**	**mg/m^3**	**R**	**2.07E-03**	**mg/kg-day**	**8.1E-02**	**$(mg/kg\text{-}day)^{-1}$**	**2.4E-05**
	Dibromochloromethane	0.013	mg/L	1.4E-04	mg/m^3	R	2.07E-03	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Methylene chloride	**5**	**mg/L**	**4.4E+01**	mg/m^3	**R**	**2.07E-03**	**mg/kg-day**	**1.6E-03**	**$(mg/kg\text{-}day)^{-2}$**	**1.5E-04**
	Toluene	140	mg/L	2.8E+01	mg/m^3	R	2.07E-03	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-2}$	N/A
											7E-04

See Table 56 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
R = Route-specific concentration
$\mu g/m^3$ = micrograms per cubic meter

TABLE 79C
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Receptor Population:	Offsite Agricultural Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient			
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Ingestion	Inhalation	Dermal	Exposure Routes Total
Water	Alluvial Groundwater	Offsite Agricultural Wells	1,1,2-Trichloroethane	N/A	2E-06	N/A	2E-06	1,1,2-Trichloroethane	N/A	N/A	N/A	N/A
			1,2-Dichloroethane	N/A	5E-04	N/A	5E-04	1,2-Dichloroethane	N/A	12	N/A	12
			1,2-Dichloropropane	N/A	N/A	N/A	N/A	1,2-Dichloropropane	N/A	0.36	N/A	0.36
			4-Methyl-2-Pentanone (MIBK)	N/A	N/A	N/A	N/A	4-Methyl-2-Pentanone (MIBK)	N/A	0.01	N/A	0.01
			Acetone	N/A	N/A	N/A	N/A	Acetone	N/A	N/A	N/A	N/A
			Benzene	N/A	1E-05	N/A	1E-05	Benzene	N/A	0.74	N/A	0.74
			Bromodichloromethane	N/A	N/A	N/A	N/A	Bromodichloromethane	N/A	N/A	N/A	N/A
			Bromoform	N/A	1E-07	N/A	1E-07	Bromoform	N/A	N/A	N/A	N/A
			Chlorobenzene	N/A	N/A	N/A	N/A	Chlorobenzene	N/A	0.048	N/A	0.048
			Chloroform	N/A	2E-05	N/A	2E-05	Chloroform	N/A	9.72E+00	N/A	9.72
			Dibromochloromethane	N/A	N/A	N/A	N/A	Dibromochloromethane	N/A	N/A	N/A	N/A
			Methylene chloride	N/A	1E-04	N/A	1E-04	Methylene chloride	N/A	0.30	N/A	0.30
			Toluene	N/A	N/A	N/A	N/A	Toluene	N/A	1.4	N/A	1.4
						Total Risk Across[Air]	7E-04	Total Hazard Index Across All Media and All Exposure Routes				24
						Total Risk Across All Media and All Exposure Routes	7E-04					

N/A = Not Applicable

TABLE 80
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient			
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Perched Groundwater	Site 1 & 2	N/A	N/A	N/A	N/A	N/A	3,4-Dichloroaniline	3	N/A	69	72
								4-Chloroaniline	0.28	N/A	7	7
								1,2-Dichloroethane	0	N/A	0	1
								Methylene chloride	2	N/A	4	6
Soil	Surface and Subsurface Soil	Site 2	N/A	N/A	N/A	N/A	N/A	1,2-Dichloroethane	3E-05	1.3	3.2E-05	1.3
Soil	Subsurface Soil	Site 3	N/A	N/A	N/A	N/A	N/A	Dinoseb	15	N/A	25	40
Soil	Surface and Subsurface Soil	Site 4	N/A	N/A	N/A	N/A	N/A	3,4- Dichloroaniline	3	N/A	6	9
								Dinoseb	1	N/A	2	3
Soil	Surface and Subsurface Soil	Site 9	N/A	N/A	N/A	N/A	N/A	Dinoseb	33	N/A	56	89
								Propanil	0.9	N/A	1.5	2

Total Risk Across[Soil]	N/A
Total Risk Across[Groundwater]	N/A
Total Risk Across All Media and All Exposure Routes	N/A

otal Hazard Index Across All Media and All Exposure Routes By Site

Site 1	86
Site 2	88
Site 3	40
Site 4	13
Site 9	91

N/A = Not Applicable. Carcinogenic or noncarcinogenic risks did not exceed 1E-04 or 1, respectively.

TABLE 81
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Receptor Population: Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Site 9	N/A	N/A	N/A	N/A	N/A	Heptachlor	0.0015	N/A	0.024	0.026
			N/A	N/A	N/A	N/A	N/A	Dinoseb	14	N/A	233	247
			N/A	N/A	N/A	N/A	N/A	Propanil	0.4	N/A	6.4	7
						Total Risk Across[Surface Soil]	N/A	otal Hazard Index Across All Media and All Exposure Routes				
											Site 9	254

N/A = Not Applicable. Carcinogenic or noncarcinogenic risks did not exceed 1E-04 or 1, respectively.

TABLE 82
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Receptor Population: Trespasser
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient			
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Site 9	N/A	N/A	N/A	N/A	N/A	Dinoseb	5	N/A	75	80
								Propanil	0.13	N/A	2	2
						Total Risk Across[Soil]	N/A	Total Hazard Index Across All Media and All Exposure Routes				82

N/A = Not Applicable. Carcinogenic or noncarcinogenic risks did not exceed 1E-04 or 1, respectively.

TABLE 83
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Receptor Population: Offsite Agricultural Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Alluvial Groundwater	Offsite	1,2-Dichloroethane	N/A	5E-04	N/A	5E-04	1,2-Dichloroethane	N/A	12	N/A	12
			Methylene chloride	N/A	1E-04	N/A	1E-04	Methylene chloride	N/A	0.3	N/A	0.3
			Toluene	N/A	N/A	N/A	N/A	Toluene	N/A	1.4	N/A	1.4
						Total Risk Across[Soil]	7E-04	Total Hazard Index Across All Media and All Exposure Routes				14

N/A = Not Applicble. Carcinogenic or noncarcinogenic risks did not exceed 1E-04 or 1, respectively.

TABLE 84A
CALCULATION OF NON-CANCER HAZARDS
CENTRAL TENDENCY EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater
Exposure Point:	Perched Groundwater
Receptor Population:	Construction Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	3,4-Dichloroaniline	11.7	mg/L	N/A	N/A	M	3.1E-05	L/kg-day	4E-03	mg/kg-day	N/A	N/A	0.09
	4-Chloroaniline	0.686	mg/L	N/A	N/A	M	3.1E-05	L/kg-day	4E-03	mg/kg-day	N/A	N/A	0.005
	Methylene chloride	60	mg/L	N/A	N/A	M	3.1E-05	L/kg-day	6E-02	mg/kg-day	N/A	N/A	0.03
Dermal	3,4-Dichloroaniline	11.7	mg/L	N/A	N/A	M	3.49E-04	L/kg-day	2E-03	mg/kg-day	N/A	N/A	2
	4-Chloroaniline	0.686	mg/L	N/A	N/A	M	3.49E-04	L/kg-day	2E-03	mg/kg-day	N/A	N/A	0.12
	Methylene chloride	60	mg/L	N/A	N/A	M	5.07E-05	L/kg-day	4.8E-02	mg/kg-day	N/A	N/A	0.06
Total Hazard Index Across All Exposure Routes/Pathways													2

(1) Route-Specific (M) EPC selected for hazard calculation.
(2) Subchronic

See Table 42 for definitions and sources of equation variables for pathway-specific intake factor calculations.

mg/L = milligrams per liter
L/kg-day = liters per kilogram day
N/A = not applicable

TABLE 84B
CALCULATION OF CANCER RISKS
CENTRAL TENDENCY EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater
Exposure Point:	Perched Groundwater
Receptor Population:	Construction Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	3,4-Dichloroaniline	11.7	mg/L	N/A	N/A	M	4.47E-07	L/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	4-Chloroaniline	0.686	mg/L	N/A	N/A	M	4.47E-07	L/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Methylene chloride	60	mg/L	N/A	N/A	M	4.47E-07	L/kg-day	7.5E-03	$(mg/kg\text{-}day)^{-1}$	2.01E-07
Dermal	3,4-Dichloroaniline	11.7	mg/L	N/A	N/A	M	4.99E-06	L/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	4-Chloroaniline	0.686	mg/L	N/A	N/A	M	4.99E-06	L/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Methylene chloride	60	mg/L	N/A	N/A	M	7.25E-07	L/kg-day	9.4E-03	$(mg/kg\text{-}day)^{-1}$	4.08E-07
										Total Risk Across All Exposure Routes/Pathways	6.1E-07

(1) Route-Specific (M) EPC selected for hazard calculation.

See Table 42 for definitions and sources of equation variables for pathway-specific intake factor calculations.

mg/L = milligrams per liters
L/kg-day = liters per kilogram day
N/A = not applicable

TABLE 84C
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
CENTRAL TENDENCY EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient			
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Perched Groundwater	Site 1 & 2	3,4-Dichloroaniline	N/A	N/A	N/A	N/A	3,4-Dichloroaniline	0.09	N/A	2	2
			4-Chloroaniline	N/A	N/A	N/A	N/A	4-Chloroaniline	0.01	N/A	0.12	0.13
			Methylene chloride	2E-07	N/A	4E-07	6E-07	Methylene chloride	0.03	N/A	0.06	0.09
						Total Risk Across[Groundwater]	6E-07	Total Hazard Index Across All Media and All Exposure Routes				2
						Total Risk Across All Media and All Exposure Routes	6E-07					

TABLE 85A
CALCULATION OF NON-CANCER HAZARDS
CENTRAL TENDENCY EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Subsurface Soil
Exposure Point:	Site 3 Subsurface Soil
Receptor Population:	Construction Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Dinoseb	2,784	mg/kg	N/A	N/A	M	3.91E-08	kg/kg-day	1E-03	mg/kg-day	N/A	N/A	0.11
Inhalation	Dinoseb	2,784	mg/kg	N/A	N/A	M	9.01E-12	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
Dermal	Dinoseb	2,784	mg/kg	N/A	N/A	M	1.03E-08	kg/kg-day	5E-04	mg/kg-day	N/A	N/A	0.057
Total Hazard Index Across All Exposure Routes/Pathways													<1

See Table 35 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Media-specific concentration
mg/cu. M = milligrams per cubic meter

TABLE 85B
CALCULATION OF CANCER RISKS
CENTRAL TENDENCY EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Subsurface Soil
Exposure Point:	Site 3 Subsurface Soil
Receptor Population:	Construction Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Dinoseb	2784	mg/kg	N/A	N/A	M	5.59E-10	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
Inhalation	Dinoseb	2784	mg/kg	N/A	N/A	M	1.29E-13	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
Dermal	Dinoseb	2784	mg/kg	N/A	N/A	M	1.48E-10	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
										Total Risk Across All Exposure Routes/Pathways	N/A

See Table 35 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Medium-specific concentration

TABLE 85C
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
CENTRAL TENDENCY EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient			
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Subsurface Soil	Site 3	Dinoseb	N/A	N/A	N/A	N/A	Dinoseb	0.1	N/A	0.057	0.17

Total Risk Across[Soil]	N/A
Total Risk Across[Groundwater]	N/A
Total Risk Across All Media and All Exposure Routes	N/A
Total Hazard Index Across All Media and All Exposure Routes	<1

N/A = Not Applicable

TABLE 86A
CALCULATION OF NON-CANCER HAZARDS
CENTRAL TENDENCY EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Subsurface Soil
Exposure Point:	Site 4 Subsurface Soil
Receptor Population:	Construction Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	3,4- Dichloroaniline	1667	mg/kg	N/A	N/A	M	3.91E-08	kg/kg-day	4E-03	mg/kg-day	N/A	N/A	3.4
	Dinoseb	244	mg/kg	N/A	N/A	M	3.91E-08	kg/kg-day	1E-03	mg/kg-day	N/A	N/A	1.2
Inhalation	3,4- Dichloroaniline	12000	mg/kg	N/A	N/A	M	9.01E-12	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Dinoseb	244	mg/kg	N/A	N/A	M	9.01E-12	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
Dermal	3,4- Dichloroaniline	12000	mg/kg	N/A	N/A	M	1.03E-08	kg/kg-day	2E-03	mg/kg-day	N/A	N/A	5.8
	Dinoseb	244	mg/kg	N/A	N/A	M	1.03E-08	kg/kg-day	5E-04	mg/kg-day	N/A	N/A	2.1
												Total Hazard Index Across All Exposure Routes/Pathways	13

See Table 35 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Media-specific concentration
mg/cu. M = milligrams per cubic meter

TABLE 86B
CALCULATION OF CANCER RISKS
CENTRAL TENDENCY EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Subsurface Soil
Exposure Point:	Site 4 Subsurface Soil
Receptor Population:	Construction Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	3,4-Dichloroaniline	1667	mg/kg	N/A	N/A	M	5.59E-10	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Dinoseb	244	mg/kg	N/A	N/A	M	5.59E-10	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
Inhalation	3,4-Dichloroaniline	1667	mg/kg	N/A	N/A	M	1.29E-13	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Dinoseb	244	mg/kg	N/A	N/A	M	1.29E-13	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
Dermal	3,4-Dichloroaniline	1667	mg/kg	N/A	N/A	M	1.48E-10	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Dinoseb	244	mg/kg	N/A	N/A	M	1.48E-10	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
										Total Risk Across All Exposure Routes/Pathways	N/A

See Table 35 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Medium-specific concentration

TABLE 86C
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
CENTRAL TENDENCY EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient			
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface and Subsurface Soil	Site 4	3,4-Dichloroaniline	N/A	N/A	N/A	N/A	3,4-Dichloroaniline	3.4	N/A	5.8	9
			Dinoseb	N/A	N/A	N/A	N/A	Dinoseb	1.2	N/A	2.1	3
						Total Risk Across[Soil]	N/A	al Hazard Index Across All Media and All Exposure Routes				13

TABLE 87A
CALCULATION OF NON-CANCER HAZARDS
CENTRAL TENDENCY EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Surface and Subsurface Soil
Exposure Point:	Site 9 Subsurface Soil
Receptor Population:	Construction Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	3,4-Dichloroaniline	450	mg/kg	N/A	N/A	M	3.91E-08	kg/kg-day	4E-03	mg/kg-day	N/A	N/A	0.130
	Dinoseb	5380	mg/kg	N/A	N/A	M	3.91E-08	kg/kg-day	1E-03	mg/kg-day	N/A	N/A	0.21
	Propanil	445	mg/kg	N/A	N/A	M	3.91E-08	kg/kg-day	5E-03	mg/kg-day	N/A	N/A	0.003
Inhalation	3,4-Dichloroaniline	450	mg/kg	N/A	N/A	M	9.01E-12	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Dinoseb	5380	mg/kg	N/A	N/A	M	9.01E-12	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Propanil	445	mg/kg	N/A	N/A	M	9.01E-12	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
Dermal	3,4-Dichloroaniline	450	mg/kg	N/A	N/A	M	1.03E-08	kg/kg-day	2E-03	mg/kg-day	N/A	N/A	0.22
	Dinoseb	5380	mg/kg	N/A	N/A	M	1.03E-08	kg/kg-day	5E-04	mg/kg-day	N/A	N/A	0.11
	Propanil	445	mg/kg	N/A	N/A	M	1.03E-08	kg/kg-day	2.5E-03	mg/kg-day	N/A	N/A	0.002
												Total Hazard Index Across All Exposure Routes/Pathways	<1

See Table 35 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Media-specific concentration

TABLE 87B
CALCULATION OF CANCER RISKS
CENTRAL TENDENCY EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Surface and Subsurface Soil
Exposure Point:	Site 9 Subsurface Soil
Receptor Population:	Construction Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	3,4-Dichloroaniline	450	mg/kg	N/A	N/A	M	5.59E-10	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Dinoseb	5380	mg/kg	N/A	N/A	M	5.59E-10	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Propanil	445	mg/kg	N/A	N/A	M	5.59E-10	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
Inhalation	3,4-Dichloroaniline	450	mg/kg	N/A	N/A	M	1.29E-13	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Dinoseb	5380	mg/kg	N/A	N/A	M	1.29E-13	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Propanil	445	mg/kg	N/A	N/A	M	1.29E-13	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
Dermal	3,4-Dichloroaniline	450	mg/kg	N/A	N/A	M	1.48E-10	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Dinoseb	5380	mg/kg	N/A	N/A	M	1.48E-10	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Propanil	445	mg/kg	N/A	N/A	M	1.48E-10	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
										Total Risk Across All Exposure Routes/Pathways	N/A

See Table 35 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Medium-specific concentration

TABLE 87C

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient			
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface and Subsurface Soil	Site 9	3,4-Dichloroaniline	N/A	N/A	N/A	N/A	3,4-Dichloroaniline	0.13	N/A	0.22	0.35
			Dinoseb	N/A	N/A	N/A	N/A	Dinoseb	0.21	N/A	0.11	0.32
			Propanil	N/A	N/A	N/A	N/A	Propanil	0.003	N/A	0.002	0.01
						Total Risk Across[Soil]	N/A	Total Hazard Index Across All Media and All Exposure Routes				<1

TABLE 88A
CALCULATION OF NON-CANCER HAZARDS
CENTRAL TENDENCY EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 9 Surface Soil
Receptor Population:	Adult Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Dinoseb	7593	mg/kg	N/A	N/A	M	4.89E-08	kg/kg-day	1E-03	mg/kg-day	N/A	N/A	0.4
	Propanil	3796	mg/kg	N/A	N/A	M	4.89E-08	kg/kg-day	5E-03	mg/kg-day	N/A	N/A	0.037
Inhalation	Dinoseb	7593	mg/kg	N/A	N/A	M	8.38E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Propanil	3796	mg/kg	N/A	N/A	M	8.38E-11	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
Dermal	Dinoseb	7593	mg/kg	N/A	N/A	M	1.29E-07	kg/kg-day	5E-04	mg/kg-day	N/A	N/A	2
	Propanil	3796	mg/kg	N/A	N/A	M	1.29E-07	kg/kg-day	2.5E-03	mg/kg-day	N/A	N/A	0.2
												Total Hazard Index Across All Exposure Routes/Pathways	3

See Table 45 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Media-specific concentration
mg/cu. M = milligrams per cubic meter

TABLE 88B
CALCULATION OF CANCER RISKS
CENTRAL TENDENCY EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 9 Surface Soil
Receptor Population:	Adult Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Dinoseb	7593	mg/kg	N/A	N/A	M	4.61E-09	kg/kg-day	N/A	$(mg/kg-day)^{-1}$	N/A
	Propanil	3796	mg/kg	N/A	N/A	M	4.61E-09	kg/kg-day	N/A	$(mg/kg-day)^{-1}$	N/A
Inhalation	Dinoseb	7593	mg/kg	N/A	N/A	M	7.90E-12	kg/kg-day	N/A	$(mg/kg-day)^{-1}$	N/A
	Propanil	3796	mg/kg	N/A	N/A	M	7.90E-12	kg/kg-day	ND	$(mg/kg-day)^{-1}$	N/A
Dermal	Dinoseb	7593	mg/kg	N/A	N/A	M	1.22E-08	kg/kg-day	N/A	$(mg/kg-day)^{-1}$	N/A
	Propanil	3796	mg/kg	N/A	N/A	M	1.22E-08	kg/kg-day	N/A	$(mg/kg-day)^{-1}$	N/A
										Total Risk Across All Exposure Routes/Pathways	N/A

See Table 45 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Medium-specific concentration
ND = No data available

TABLE 88C

RISK ASSESSMENT SUMMARY

CENTRAL TENDENCY EXPOSURE

CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Receptor Population: Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient			
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Site 9	Dinoseb	N/A	N/A	N/A	N/A	Dinoseb	0.37	N/A	2	2.33
			Propanil	N/A	N/A	N/A	N/A	Propanil	0.04	N/A	0.20	0.23

Total Risk Across[Soil]	N/A
Total Risk Across All Media and All Exposure Routes	N/A
Total Hazard Index Across All Media and All Exposure Routes	3

TABLE 89A
CALCULATION OF NON-CANCER HAZARDS
CENTRAL TENDENCY EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 9 Surface Soil
Receptor Population:	Trespasser
Receptor Age:	Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Dinoseb	7593	mg/kg	N/A	N/A	M	7.91E-09	kg/kg-day	1E-03	mg/kg-day	N/A	N/A	0.1
	Propanil	3796	mg/kg	N/A	N/A	M	7.91E-09	kg/kg-day	5E-03	mg/kg-day	N/A	N/A	0.01
Inhalation	Dinoseb	7593	mg/kg	N/A	N/A	M	8.71E-12	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
	Propanil	3796	mg/kg	N/A	N/A	M	8.71E-12	kg/kg-day	N/A	mg/kg-day	N/A	N/A	N/A
Dermal	Dinoseb	7593	mg/kg	N/A	N/A	M	2.09E-08	kg/kg-day	5E-04	mg/kg-day	N/A	N/A	0.3
	Propanil	3796	mg/kg	N/A	N/A	M	2.09E-08	kg/kg-day	2.5E-03	mg/kg-day	N/A	N/A	0.03
Total Hazard Index Across All Exposure Routes/Pathways													<1

See Table 49 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Media-specific concentration
mg/cu. M = milligram per cubic meter

TABLE 89B
CALCULATION OF CANCER RISKS
CENTRAL TENDENCY EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Surface Soil
Exposure Point:	Site 9 Surface Soil
Receptor Population:	Trespasser
Receptor Age:	Adolescent

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Dinoseb	7593	mg/kg	N/A	N/A	M	1.13E-09	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Propanil	3796	mg/kg	N/A	N/A	M	1.13E-09	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
Inhalation	Dinoseb	7593	mg/kg	N/A	N/A	M	1.24E-12	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Propanil	3796	mg/kg	N/A	N/A	M	1.24E-12	kg/kg-day	ND	$(mg/kg\text{-}day)^{-1}$	N/A
Dermal	Dinoseb	7593	mg/kg	N/A	N/A	M	2.99E-09	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
	Propanil	3796	mg/kg	N/A	N/A	M	2.99E-09	kg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
Total Risk Across All Exposure Routes/Pathways											N/A

See Table 49 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable
M = Medium-specific concentration
ND = No data available

TABLE 89C

RISK ASSESSMENT SUMMARY

CENTRAL TENDENCY EXPOSURE

CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Receptor Population: Trespasser
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient			
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Site 9	Dinoseb	N/A	N/A	N/A	N/A	Dinoseb	0.1	N/A	0.3	0
			Propanil	N/A	N/A	N/A	N/A	Propanil	0.0	N/A	0.0	0

Total Risk Across[Soil]	N/A
Total Risk Across All Media and All Exposure Routes	N/A
Total Hazard Index Across All Media and All Exposure Routes	0

TABLE 90A
CALCULATION OF NON-CANCER HAZARDS
CENTRAL TENDENCY EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Groundwater
Exposure Medium:	Alluvial Groundwater
Exposure Point:	Alluvial Groundwater
Receptor Population:	Offsite Agricultural Workers
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (2)	Reference Dose Units	Reference Concentratio	Reference Concentration Units	Hazard Quotient
Inhalation	1,2-Dichloroethane	8.29E+00	mg/L	2.72E-01	mg/m^3	M	2.9E-03	mg/kg-day	2.86E-03	mg/kg-day	N/A	N/A	0.28
	Chloroform	1.40E+00	mg/L	7.60E-04	mg/m^3	M	5.8E-03	mg/kg-day	8.60E-05	mg/kg-day	N/A	N/A	0.05
	Methylene Chloride	1.47E+00	mg/L	7.30E-02	mg/m^3	M	2.9E-03	mg/kg-day	8.57E-01	mg/kg-day	N/A	N/A	0.0002
	Toluene	3.14E+01	mg/L	4.56E+00	mg/m^3	M	2.9E-03	mg/kg-day	1.14E-01	mg/kg-day	N/A	N/A	0.12
												Total Hazard Index Across All Exposure Routes/Pathways	<1

See Table 55 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/L = milligrams per liter
N/A = Not applicable
R = Route-specific concentration
$\mu g/m^3$ = micrograms per cubic meter
mg/kg-day = milligrams per kilogram day

TABLE 90B
CALCULATION OF CANCER RISKS
CENTRAL TENDENCY EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Groundwater
Exposure Medium:	Alluvial Groundwater
Exposure Point:	Alluvial Groundwater
Receptor Population:	Offsite Agricultural Workers
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation	1,2-Dichloroethane	8.70E+01	mg/L	2.72E-01	mg/m^3	M	1.03E-03	mg/kg-day	9.10E-02	$(mg/kg\text{-}day)^{-1}$	3E-05
	Chloroform	1.40E+00	mg/L	7.60E-04	mg/m^3	M	2.07E-03	mg/kg-day	8.10E-02	$(mg/kg\text{-}day)^{-1}$	1E-07
	Methylene chloride	5.00E+00	mg/L	7.30E-02	mg/m^3	M	1.03E-03	mg/kg-day	1.65E-03	$(mg/kg\text{-}day)^{-1}$	1E-07
	Toluene	1.40E+02	mg/L	4.56E+00	mg/m^3	M	1.03E-03	mg/kg-day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A
										Total Risk Across All Exposure Routes/Pathways	3E-05

See Table 55 for definitions and sources of equation variables for pathway-specific intake factor calculations.

EPC = Exposure point concentration
mg/L = milligrams per liter
N/A = Not applicable
R = Route-specific concentration
$\mu g/m^3$ = micrograms per cubic meter
mg/kg-day = milligrams per kilogram day

TABLE 90C
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
CENTRAL TENDENCY EXPOSURE
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Future
Receptor Population: Offsite Agricultural Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient			
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Ingestion	Inhalation	Dermal	Exposure Routes Total
Water	Alluvial Groundwater	Offsite Agricultural Wells	1,2-Dichloroethane	N/A	3E-05	N/A	3E-05	1,2-Dichloroethane	N/A	0.28	N/A	0.28
			Chloroform	N/A	1E-07	N/A	1E-07	Chloroform	N/A	0.105	N/A	0.105
			Methylene chloride	N/A	1E-07	N/A	1E-07	Methylene chloride	N/A	0.0002	N/A	0.0002
			Toluene	N/A	N/A	N/A	N/A	Toluene	N/A	0.12	N/A	0.12
					Total Risk Across[Air]		3E-05	Total Hazard Index Across All Media and All Exposure Routes				<1
					Total Risk Across All Media and All Exposure Routes		3E-05					

N/A = Not applicable

TABLE 91
REMEDIAL GOAL OPTIONS
SITE 1 SEDIMENT
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

					Remedial Goal Options (mg/kg)					
					Carcinogenic Risk			Noncarcinogenic Risk		
Receptor	Parameter	EPC (1) (mg/kg)	Estimated Carcinogenic Risk	Estimated Noncarcinogenic Risk	1E-06	1E-05	1E-04	0.1	1	3
Construction Worker	Arsenic	123	4.1E-06	0.2	30	300	3000	N/A	N/A	N/A
Adult Worker (2)	N/A	N/A	N/A	N/A	N/A	N/A	NA	N/A	N/A	N/A
Trespasser	Arsenic	123	6E-05	0.3	2	20.5	205	N/A	N/A	N/A

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not Applicable

(1) Because of the small sample size for this medium, the maximum concentration was selected as the EPC. Refer to Tables 18 and 23 for the EPC statistics for this site.

(2) Based on the definition of their respective exposure scenarios, adult workers are not exposed to sediment. RGOs were not calculated for this

TABLE 92
REMEDIAL GOAL OPTIONS
SITE 2 SURFACE AND SUBSURFACE SOIL
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

					Remedial Goal Options (mg/kg)					
					Carcinogenic Risk			Noncarcinogenic Risk		
Receptor	Parameter	EPC (1) (mg/kg)	Estimated Carcinogenic Risk	Estimated Noncarcinogenic Risk	1E-06	1E-05	1E-04	0.1	1	3
Construction Worker	1,2-Dichloroethane	0.81	9E-07	1	N/A	N/A	NA	0.056	0.56	1.68
Adult Worker (2)	N/A	N/A	N/A	N/A	N/A	N/A	NA	N/A	N/A	N/A
Trespasser	N/A	N/A	N/A	N/A	N/A	N/A	NA	N/A	N/A	N/A

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not Applicable

(1) Based on the definition of their respective exposure scenarios, adult workers and trespassers are not exposed to subsurface soil. RGOs were not calculated for these receptors for this medium.

TABLE 93
REMEDIAL GOAL OPTIONS
SITE 3 SUBSURFACE SOIL
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

					Remedial Goal Options (mg/kg)					
					Carcinogenic Risk			Noncarcinogenic Risk		
Receptor	Parameter	EPC (1) (mg/kg)	Estimated Carcinogenic Risk	Estimated Noncarcinogenic Risk	1E-06	1E-05	1E-04	0.1	1	3
Construction Worker	Dinoseb (1)	13,000	N/A	40	N/A	N/A	NA	33	328	983
Adult Worker (2)	N/A	N/A	N/A	N/A	N/A	N/A	NA	N/A	N/A	N/A
Trespasser (2)	N/A	N/A	N/A	N/A	N/A	N/A	NA	N/A	N/A	N/A

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not Applicable

(1) USEPA does not classify Dinoseb as a carcinogen; therefore, RGOs are calculated based on noncarcinogenic risk.
statistics for this site.

(2) Based on the definition of their respective exposure scenarios, adult workers and trespassers are not exposed to subsurface soil. RGOs were not calculated for these receptors for this medium.

TABLE 94
REMEDIAL GOAL OPTIONS
SITE 4 SURFACE AND SUBSURFACE SOIL
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

					Remedial Goal Options (mg/kg)					
					Carcinogenic Risk			Noncarcinogenic Risk		
Receptor	Parameter	EPC (1) (mg/kg)	Estimated Carcinogenic Risk	Estimated Noncarcinogenic Risk	1E-06	1E-05	1E-04	0.1	1	3
Construction Worker	3,4-Dichloroaniline (1)	12,000	N/A	9	N/A	N/A	NA	130	1304	3913
	Dinoseb	1,100	N/A	3	N/A	N/A	NA	33	333	1000
Adult Worker (2)	N/A	N/A	N/A	N/A	N/A	N/A	NA	N/A	N/A	N/A
Trespasser (2)	N/A	N/A	N/A	N/A	N/A	N/A	NA	N/A	N/A	N/A

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not Applicable

(1) USEPA does not classify 3,4-dichloroaniline and Dinoseb as carcinogens; therefore, RGOs are calculated based on noncarcinogenic risk. statistics for this site.

(2) Based on the definition of their respective exposure scenarios, adult workers and trespassers are not exposed to subsurface soil. RGOs were not calculated for these receptors for this medium.

TABLE 95
REMEDIAL GOAL OPTIONS
SITE 9 SURFACE AND SUBSURFACE SOIL
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Medium: **Surface Soil (1)**

					Remedial Goal Options (mg/kg)					
					Carcinogenic Risk			Noncarcinogenic Risk		
Receptor	Parameter	EPC (1) (mg/kg)	Estimated Carcinogenic Risk	Estimated Noncarcinogenic Risk	1E-06	1E-05	1E-04	0.1	1	3
Adult Worker	Dinoseb (2)	29,000	N/A	247	N/A	N/A	NA	12	117	352
	Propanil (2)	4,000	N/A	7	N/A	N/A	NA	59	587	1762
Trespasser	Dinoseb (2)	29,000	N/A	80	N/A	N/A	NA	36	363	1089
	Propanil (2)	4,000	N/A	2	N/A	N/A	NA	182	1815	5446

Medium: **Surface and Subsurface Soil (1)**

					Remedial Goal Options (mg/kg)					
					Carcinogenic Risk			Noncarcinogenic Risk		
Receptor	Parameter	EPC (1) (mg/kg)	Estimated Carcinogenic Risk	Estimated Noncarcinogenic Risk	1E-06	1E-05	1E-04	0.1	1	3
Construction Worker	Dinoseb (2)	29,000	N/A	89	N/A	N/A	NA	33	327	982
	Propanil (2)	4,000	N/A	2	N/A	N/A	NA	164	1636	4908
Adult Worker (3)	N/A	N/A	N/A	N/A	N/A	N/A	NA	N/A	N/A	N/A
Trespasser (3)	N/A	N/A	N/A	N/A	N/A	N/A	NA	N/A	N/A	N/A

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not Applicable

(1) Because of the small sample size for this site, the maximum concentration was selected asthe EPC for both the surface and subsurface soil and surface soil pathways.
(2) USEPA does not classify Dinoseb and Propanil as carcinogens; therefore, RGOs are calculated based on noncarcinogenic risk. statistics for this site.
(3) Based on the definition of their respective exposure scenarios, adult workers and trespassers are not exposed to subsurface soil. RGOs were not calculated for these receptors for this medium.

TABLE 96
REMEDIAL GOAL OPTIONS
PERCHED GROUNDWATER
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

					Remedial Goal Options (mg/kg)					
					Carcinogenic Risk			Noncarcinogenic Risk		
Receptor	Parameter	EPC (1) (mg/kg)	Estimated Carcinogenic Risk	Estimated Noncarcinogenic Risk	1E-06	1E-05	1E-04	0.1	1	3
Construction Worker	3,4-Dichloroaniline	58	N/A	72	N/A	N/A	NA	0.08	0.8	2.4
	4-Chloroaniline	5.9	N/A	7	N/A	N/A	NA	0.08	0.8	2.4
	1,2-Dichloroethane	29	2.63E-05	1	1	11	110	4.30	43.0	128.9
	Methylene chloride	600	3.99E-05	6	15	150	1503	9.7	97	290
Adult Worker (3)	N/A	N/A	N/A	N/A	N/A	N/A	NA	N/A	N/A	N/A
Trespasser (3)	N/A	N/A	N/A	N/A	N/A	N/A	NA	N/A	N/A	N/A

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not Applicable

(1) Because of the small sample size for this site, the maximum concentration was selected asthe EPC for both the surface and subsurface soil and surface soil pathways.
(2) USEPA does not classify 3,4-dichloroaniline and 4-chloroaniline as carcinogens; therefore, RGOs are calculated based on noncarcinogenic risk. statistics for this site.
(3) Based on the definition of their respective exposure scenarios, adult workers and trespassers are not exposed to perched groundwater. RGOs were not calculated for these receptors for this medium.

TABLE 97
REMEDIAL GOAL OPTIONS
ALLUVIAL GROUNDWATER
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

					Remedial Goal Options (mg/kg)					
					Carcinogenic Risk			Noncarcinogenic Risk		
Receptor	Parameter	EPC (1) (mg/kg)	Estimated Carcinogenic Risk	Estimated Noncarcinogenic Risk	1E-06	1E-05	1E-04	0.1	1	3
Offsite Agricultural Worker	1,2-Dichloroethane	2.9	5.38E-04	12	5E-03	5E-02	5E-01	0.02	0.2	0.7
	Benzene	0.22	1.30E-05	1	2E-02	2E-01	2E+00	N/A	N/A	N/A
	Chloroform	0.14	2.42E-05	9.72411	6E-03	6E-02	6E-01	0.0	0	0
	Methylene chloride	44.2	1.46E-04	0.30	3E-01	3E+00	3E+01	15	148	445
	Toluene	28	N/A	1.4	N/A	N/A	NA	2	20	59
Construction Worker	N/A	N/A	N/A	N/A	N/A	N/A	NA	N/A	N/A	N/A
Adult Worker (3)	N/A	N/A	N/A	N/A	N/A	N/A	NA	N/A	N/A	N/A
Trespasser (3)	N/A	N/A	N/A	N/A	N/A	N/A	NA	N/A	N/A	N/A

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not Applicable

(1) USEPA does not classify 1,2-dichloropropane and chlorobenzene as carcinogens; therefore, RGOs are calculated based on noncarcinogenic risk.
(2) USEPA does not classify chloroform as a noncarcinogen; therefore, RGOs are calculated based on carcinogenic risk.
statistics for this site.
(3) Based on the definition of their respective exposure scenarios, adult workers and trespassers are not exposed to perched groundwater. RGOs were not calculated for these receptors for this medium.

A

Appendix G

Central Tendency Intake Factor Calculations

TABLE G1
INGESTION-SPECIFIC INTAKE FACTOR
CENTRAL TENDENCY EXPOSURE
CONSTRUCTION WORKER EXPOSURE: INGESTION OF CHEMICALS IN SOIL AND DUST
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

EQUATION UNITS	IF oral kg/kg-day	=	(	IR mg/day	×	EF days/yr	×	ED yr	×	FI Unitless	×	CF kg/mg	)	÷	(	BW kg	×	AT days	)
NONCARCINOGENIC	3.91E-08	=	(	50	×	20	×	1	×	1	×	1E-06	)	÷	(	70	×	365	)
CARCINOGENIC	5.59E-10	=	(	50	×	20	×	1	×	1	×	1E-06	)	÷	(	70	×	25,550	)

See Table 35 for definitions and sources of equation variables identified as follows:

IF = intake factor
AT = averaging time
BW = body weight
FI = fraction ingested

IR = ingestion rate
EF = exposure frequency
ED = exposure duration
CF = conversion factor

TABLE G2
INHALATION-SPECIFIC INTAKE FACTOR
CENTRAL TENDENCY EXPOSURE
CONSTRUCTION WORKER EXPOSURE: INHALATION OF AIRBORNE CHEMICALS FROM SOIL
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

EQUATION UNITS	IFinh kg/kg-day	= (	Inh R m^3/day	×	EF days/yr	×	ED yr	× 1 /	PEF m^3/kg	+ 1 /	VF m^3/kg	) ÷ (	BW kg	×	AT days	)
NONCARCINOGENIC EFFECTS																
Metals	9.01E-12	= (	15.2	×	20	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	365	)
Chromium	9.01E-12	= (	15.2	×	20	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	365	)
Dieldrin	9.01E-12	= (	15.2	×	20	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	365	)
Methoxychlor	9.01E-12	= (	15.2	×	20	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	365	)
Heptachlor	9.01E-12	= (	15.2	×	20	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	365	)
Dinoseb	9.01E-12	= (	15.2	×	20	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	365	)
Toxaphene	9.01E-12	= (	15.2	×	20	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	365	)
3,4-Dichloroaniline	9.01E-12	= (	15.2	×	20	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	365	)
Propanil	9.01E-12	= (	15.2	×	20	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	365	)
1,2-Dichloroethane	5.67E-06	= (	15.2	×	20	×	1	× 1 /	1.32E+09	+ 1 /	2.10E+03	) ÷ (	70	×	365	)
Carbon tetrachloride	1.08E-05	= (	15.2	×	20	×	1	× 1 /	1.32E+09	+ 1 /	1.10E+03	) ÷ (	70	×	365	)
Chloroform	8.50E-06	= (	15.2	×	20	×	1	× 1 /	1.32E+09	+ 1 /	1.40E+03	) ÷ (	70	×	365	)
Methylene chloride	9.15E-06	= (	15.2	×	20	×	1	× 1 /	1.32E+09	+ 1 /	1.30E+03	) ÷ (	70	×	365	)
CARCINOGENIC EFFECTS																
Metals	1.29E-13	= (	15.2	×	20	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	25,550	)
Chromium	1.29E-13	= (	15.2	×	20	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	25,550	)
Dieldrin	1.29E-13	= (	15.2	×	20	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	25,550	)
Methoxychlor	1.29E-13	= (	15.2	×	20	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	25,550	)
Heptachlor	1.29E-13	= (	15.2	×	20	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	25,550	)
Dinoseb	1.29E-13	= (	15.2	×	20	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	25,550	)
Toxaphene	1.29E-13	= (	15.2	×	20	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	25,550	)
3,4-Dichloroaniline	1.29E-13	= (	15.2	×	20	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	25,550	)
Propanil	1.29E-13	= (	15.2	×	20	×	1	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	25,550	)
1,2-Dichloroethane	8.09E-08	= (	15.2	×	20	×	1	× 1 /	1.32E+09	+ 1 /	2.10E+03	) ÷ (	70	×	25,550	)
Carbon tetrachloride	1.55E-07	= (	15.2	×	20	×	1	× 1 /	1.32E+09	+ 1 /	1.10E+03	) ÷ (	70	×	25,550	)
Chloroform	1.21E-07	= (	15.2	×	20	×	1	× 1 /	1.32E+09	+ 1 /	1.40E+03	) ÷ (	70	×	25,550	)
Methylene chloride	1.31E-07	= (	15.2	×	20	×	1	× 1 /	1.32E+09	+ 1 /	1.30E+03	) ÷ (	70	×	25,550	)

See Table 35 for definitions and sources of equation variables identified as follows:

IF = Intake factor
IR = Inhalation Rate
EF = Exposure frequency
ED = Exposure duration
PEF= Particulate emission factor
VF = Volatilization factor
BW = Body weight
AT = Averaging time

TABLE G3
DERMAL-SPECIFIC INTAKE FACTOR
CENTRAL TENDENCY EXPOSURE
CONSTRUCTION WORKER EXPOSURE: DERMAL CONTACT WITH CHEMICALS IN SOIL
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

EQUATION UNITS	IF derm kg/kg-day	= (	SA cm^2/event	×	AF mg/cm^2	×	ABS unitless	×	EF events/year	×	ED years	×	CF kg/mg	) ÷ (	BW kg	×	AT days	)
NONCARCINOGENIC																		
Arsenic	3.10E-09	= (	3.6E+03	×	0.0367	×	3E-02	×	20	×	1	×	1E-06	) ÷ (	70	×	365	)
Other Metals	1.03E-09	= (	3.6E+03	×	0.0367	×	1E-02	×	20	×	1	×	1E-06	) ÷ (	70	×	365	)
Dieldrin	1.03E-08	= (	3.6E+03	×	0.0367	×	1E-01	×	20	×	1	×	1E-06	) ÷ (	70	×	365	)
1,2-Dichloroethane	1.03E-08	= (	3.6E+03	×	0.0367	×	1E-01	×	20	×	1	×	1E-06	) ÷ (	70	×	365	)
Methoxychlor	1.03E-08	= (	3.6E+03	×	0.0367	×	1E-01	×	20	×	1	×	1E-06	) ÷ (	70	×	365	)
Heptachlor	1.03E-08	= (	3.6E+03	×	0.0367	×	1E-01	×	20	×	1	×	1E-06	) ÷ (	70	×	365	)
Dinoseb	1.03E-08	= (	3.6E+03	×	0.0367	×	1E-01	×	20	×	1	×	1E-06	) ÷ (	70	×	365	)
Toxaphene	1.03E-08	= (	3.6E+03	×	0.0367	×	1E-01	×	20	×	1	×	1E-06	) ÷ (	70	×	365	)
3,4-Dichloroaniline	1.03E-08	= (	3.6E+03	×	0.0367	×	1E-01	×	20	×	1	×	1E-06	) ÷ (	70	×	365	)
4-Chloroaniline	1.03E-08	= (	3.6E+03	×	0.0367	×	1E-01	×	20	×	1	×	1E-06	) ÷ (	70	×	365	)
Propanil	1.03E-08	= (	3.6E+03	×	0.0367	×	1E-01	×	20	×	1	×	1E-06	) ÷ (	70	×	365	)
1,2-Dichloroethane	1.03E-08	= (	3.6E+03	×	0.0367	×	1E-01	×	20	×	1	×	1E-06	) ÷ (	70	×	365	)
Carbon Tetrachloride	1.03E-08	= (	3.6E+03	×	0.0367	×	1E-01	×	20	×	1	×	1E-06	) ÷ (	70	×	365	)
Methylene chloride	1.03E-08	= (	3.6E+03	×	0.0367	×	1E-01	×	20	×	1	×	1E-06	) ÷ (	70	×	365	)
CARCINOGENIC																		
Arsenic	4.43E-11	= (	3.6E+03	×	0.0367	×	3E-02	×	20	×	1	×	1E-06	) ÷ (	70	×	25,550	)
Other Metals	1.48E-11	= (	3.6E+03	×	0.0367	×	1E-02	×	20	×	1	×	1E-06	) ÷ (	70	×	25,550	)
Dieldrin	1.48E-10	= (	3.6E+03	×	0.0367	×	1E-01	×	20	×	1	×	1E-06	) ÷ (	70	×	25,550	)
1,2-Dichloroethane	1.48E-10	= (	3.6E+03	×	0.0367	×	1E-01	×	20	×	1	×	1E-06	) ÷ (	70	×	25,550	)
Methoxychlor	1.48E-10	= (	3.6E+03	×	0.0367	×	1E-01	×	20	×	1	×	1E-06	) ÷ (	70	×	25,550	)
Heptachlor	1.48E-10	= (	3.6E+03	×	0.0367	×	1E-01	×	20	×	1	×	1E-06	) ÷ (	70	×	25,550	)
Dinoseb	1.48E-10	= (	3.6E+03	×	0.0367	×	1E-01	×	20	×	1	×	1E-06	) ÷ (	70	×	25,550	)
Toxaphene	1.48E-10	= (	3.6E+03	×	0.0367	×	1E-01	×	20	×	1	×	1E-06	) ÷ (	70	×	25,550	)
3,4-Dichloroaniline	1.48E-10	= (	3.6E+03	×	0.0367	×	1E-01	×	20	×	1	×	1E-06	) ÷ (	70	×	25,550	)
4-Chloroaniline	1.48E-10	= (	3.6E+03	×	0.0367	×	1E-01	×	20	×	1	×	1E-06	) ÷ (	70	×	25,550	)
Propanil	1.48E-10	= (	3.6E+03	×	0.0367	×	1E-01	×	20	×	1	×	1E-06	) ÷ (	70	×	25,550	)
1,2-Dichloroethane	1.48E-10	= (	3.6E+03	×	0.0367	×	1E-01	×	20	×	1	×	1E-06	) ÷ (	70	×	25,550	)
Carbon tetrachloride	1.48E-10	= (	3.6E+03	×	0.0367	×	1E-01	×	20	×	1	×	1E-06	) ÷ (	70	×	25,550	)
Methylene chloride	1.48E-10	= (	3.6E+03	×	0.0367	×	1E-01	×	20	×	1	×	1E-06	) ÷ (	70	×	25,550	)

See Table 35 for definitions and sources of equation variables identified as follows:

IF = intake factor
CF = conversion factor
SA = skin surface area available for contact
AF = soil to skin adherence factor

ABS = absorption factor
EF = exposure frequency
ED = exposure duration
BW = body weight
AT = averaging time

TABLE G4
INGESTION-SPECIFIC INTAKE FACTOR
CENTRAL TENDENCY EXPOSURE
CONSTRUCTION WORKER EXPOSURE: INGESTION OF CHEMICALS IN GROUNDWATER
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

EQUATION UNITS	IF oral kg/kg-day	=	(	IR mg/hour	×	ET hours/event	×	EF days/ yr	×	ED yr	)	÷	(	BW kg	×	AT days	)
NONCARCINOGENIC	3.13E-05	=	(	0.01	×	4	×	20	×	1	)	÷	(	70	×	365	)
CARCINOGENIC	4.47E-07	=	(	0.01	×	4	×	20	×	1	)	÷	(	70	×	25,550	)

See Table 42 for definitions and sources of equation variables identified as follows:

IF = intake factor
IR = ingestion rate
ET = exposure time
EF = exposure frequency
ED = exposure duration
BW = body weight
AT = averaging time

TABLE G5
DERMAL-SPECIFIC INTAKE FACTOR
CENTRAL TENDENCY EXPOSURE
CONSTRUCTION WORKER EXPOSURE: DERMAL CONTACT WITH CHEMICALS IN GROUNDWATER
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

EQUATION	IF derm	=	(	CF	×	SA	×	PC	×	ET	×	EF	×	ED	)	÷	(	BW	×	AT	)
UNITS	kg/kg-day			L/cm^3		cm^2/event		cm/hr		hours/day		events/year		years				kg		days	
NONCARCINOGENIC																					
Arsenic	1.13E-05	=	(	1.00E-03	×	3.6E+03	×	1.00E-03	×	4	×	20	×	1	)	÷	(	70	×	365	)
Chromium	1.13E-05	=	(	1.00E-03	×	3.6E+03	×	1.00E-03	×	4	×	20	×	1	)	÷	(	70	×	365	)
4,4-DDT	4.85E-03	=	(	1.00E-03	×	3.6E+03	×	4.30E-01	×	4	×	20	×	1	)	÷	(	70	×	365	)
alpha-BHC	2.14E-04	=	(	1.00E-03	×	3.6E+03	×	1.90E-02	×	4	×	20	×	1	)	÷	(	70	×	365	)
3,4-Dichloroaniline	3.49E-04	=	(	1.00E-03	×	3.6E+03	×	3.10E-02	×	4	×	20	×	1	)	÷	(	70	×	365	)
4-Chloroaniline	3.49E-04	=	(	1.00E-03	×	3.6E+03	×	3.10E-02	×	4	×	20	×	1	)	÷	(	70	×	365	)
Dinoseb	3.16E-04	=	(	1.00E-03	×	3.6E+03	×	2.80E-02	×	4	×	20	×	1	)	÷	(	70	×	365	)
1,2-Dichloroethane	5.97E-05	=	(	1.00E-03	×	3.6E+03	×	5.30E-03	×	4	×	20	×	1	)	÷	(	70	×	365	)
Chloroform	1.00E-04	=	(	1.00E-03	×	3.6E+03	×	8.90E-03	×	4	×	20	×	1	)	÷	(	70	×	365	)
Methylene chloride	5.07E-05	=	(	1.00E-03	×	3.6E+03	×	4.50E-03	×	4	×	20	×	1	)	÷	(	70	×	365	)
Vinyl chloride	8.23E-05	=	(	1.00E-03	×	3.6E+03	×	7.30E-03	×	4	×	20	×	1	)	÷	(	70	×	365	)
CARCINOGENIC																					
Arsenic	1.61E-07	=	(	1.00E-03	×	3.6E+03	×	1.00E-03	×	4	×	20	×	1	)	÷	(	70	×	25,550	)
Chromium	1.61E-07	=	(	1.00E-03	×	3.6E+03	×	1.00E-03	×	4	×	20	×	1	)	÷	(	70	×	25,550	)
4,4-DDT	6.92E-05	=	(	1.00E-03	×	3.6E+03	×	4.30E-01	×	4	×	20	×	1	)	÷	(	70	×	25,550	)
alpha-BHC	3.06E-06	=	(	1.00E-03	×	3.6E+03	×	1.90E-02	×	4	×	20	×	1	)	÷	(	70	×	25,550	)
3,4-Dichloroaniline	4.99E-06	=	(	1.00E-03	×	3.6E+03	×	3.10E-02	×	4	×	20	×	1	)	÷	(	70	×	25,550	)
4-Chloroaniline	4.99E-06	=	(	1.00E-03	×	3.6E+03	×	3.10E-02	×	4	×	20	×	1	)	÷	(	70	×	25,550	)
Dinoseb	4.51E-06	=	(	1.00E-03	×	3.6E+03	×	2.80E-02	×	4	×	20	×	1	)	÷	(	70	×	25,550	)
1,2-Dichloroethane	8.53E-07	=	(	1.00E-03	×	3.6E+03	×	5.30E-03	×	4	×	20	×	1	)	÷	(	70	×	25,550	)
Chloroform	1.43E-06	=	(	1.00E-03	×	3.6E+03	×	8.90E-03	×	4	×	20	×	1	)	÷	(	70	×	25,550	)
Methylene chloride	7.25E-07	=	(	1.00E-03	×	3.6E+03	×	4.50E-03	×	4	×	20	×	1	)	÷	(	70	×	25,550	)
Vinyl chloride	1.18E-06	=	(	1.00E-03	×	3.6E+03	×	7.30E-03	×	4	×	20	×	1	)	÷	(	70	×	25,550	)

See Table 42 for definitions and sources of equation variables identified as follows:

IF = intake factor
CF = conversion factor
SA = skin surface area available for contact
PC = permeability constant
EF = exposure frequency
ED = exposure duration
BW = body weight
AT = averaging time

TABLE G6
INGESTION-SPECIFIC INTAKE FACTOR
CENTRAL TENDENCY EXPOSURE
SITE WORKER EXPOSURE: INGESTION OF CHEMICALS IN SOIL
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

EQUATION UNITS	IF oral kg/kg-day	= (	IR mg/day	×	EF days/yr	×	ED yr	×	FI unitless	×	CF kg/mg	) ÷ (	BW kg	×	AT days	)
NONCARCINOGENIC	4.89E-08	= (	50	×	250	×	6.6	×	0.1	×	1.00E-06	) ÷ (	70	×	2,409	)
CARCINOGENIC	4.61E-09	= (	50	×	250	×	6.6	×	0.1	×	1.00E-06	) ÷ (	70	×	25,550	)

See Table 45 for definitions and sources of equation variables identified as follows:

IF = intake factor
AT = averaging time
BW = body weight
FI = fraction ingested
IR = ingestion rate
EF = exposure frequency
ED = exposure duration
CF = conversion factor

TABLE G7
DERMAL-SPECIFIC INTAKE FACTOR
CENTRAL TENDENCY EXPOSURE
SITE WORKER EXPOSURE: DERMAL CONTACT WITH CHEMICALS IN SOIL
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

EQUATION UNITS	IF derm kg/kg-day	= (	SA cm^2/event	×	AF mg/cm^2	×	ABS unitless	×	EF events/year	×	ED years	×	CF kg/mg	) ÷ (	BW kg	×	AT days	)
NONCARCINOGENIC																		
Arsenic	3.88E-08	= (	3600	×	0.0367	×	3.00E-02	×	250	×	6.6	×	1E-06	) ÷ (	70	×	2,409	)
Aldrin	1.29E-07	= (	3600	×	0.0367	×	1.00E-01	×	250	×	6.6	×	1E-06	) ÷ (	70	×	2,409	)
Dieldrin	1.29E-07	= (	3600	×	0.0367	×	1.00E-01	×	250	×	6.6	×	1E-06	) ÷ (	70	×	2,409	)
Heptachlor	1.29E-07	= (	3600	×	0.0367	×	1.00E-01	×	250	×	6.6	×	1E-06	) ÷ (	70	×	2,409	)
Methoxychlor	1.29E-07	= (	3600	×	0.0367	×	1.00E-01	×	250	×	6.6	×	1E-06	) ÷ (	70	×	2,409	)
3,4-Dichloroaniline	1.29E-07	= (	3600	×	0.0367	×	1.00E-01	×	250	×	6.6	×	1E-06	) ÷ (	70	×	2,409	)
Dinoseb	1.29E-07	= (	3600	×	0.0367	×	1.00E-01	×	250	×	6.6	×	1E-06	) ÷ (	70	×	2,409	)
Propanil	1.29E-07	= (	3600	×	0.0367	×	1.00E-01	×	250	×	6.6	×	1E-06	) ÷ (	70	×	2,409	)
Toxaphene	1.29E-07	= (	3600	×	0.0367	×	1.00E-01	×	250	×	6.6	×	1E-06	) ÷ (	70	×	2,409	)
1,2-Dichloroethane	1.29E-07	= (	3600	×	0.0367	×	1.00E-01	×	250	×	6.6	×	1E-06	) ÷ (	70	×	2,409	)
CARCINOGENIC																		
Arsenic	3.66E-09	= (	3600	×	0.0367	×	3.00E-02	×	250	×	6.6	×	1E-06	) ÷ (	70	×	25,550	)
Aldrin	1.22E-08	= (	3600	×	0.0367	×	1.00E-01	×	250	×	6.6	×	1E-06	) ÷ (	70	×	25,550	)
Dieldrin	1.22E-08	= (	3600	×	0.0367	×	1.00E-01	×	250	×	6.6	×	1E-06	) ÷ (	70	×	25,550	)
Heptachlor	1.22E-08	= (	3600	×	0.0367	×	1.00E-01	×	250	×	6.6	×	1E-06	) ÷ (	70	×	25,550	)
Methoxychlor	1.22E-08	= (	3600	×	0.0367	×	1.00E-01	×	250	×	6.6	×	1E-06	) ÷ (	70	×	25,550	)
3,4-Dichloroaniline	1.22E-08	= (	3600	×	0.0367	×	1.00E-01	×	250	×	6.6	×	1E-06	) ÷ (	70	×	25,550	)
Dinoseb	1.22E-08	= (	3600	×	0.0367	×	1.00E-01	×	250	×	6.6	×	1E-06	) ÷ (	70	×	25,550	)
Propanil	1.22E-08	= (	3600	×	0.0367	×	1.00E-01	×	250	×	6.6	×	1E-06	) ÷ (	70	×	25,550	)
Toxaphene	1.22E-08	= (	3600	×	0.0367	×	1.00E-01	×	250	×	6.6	×	1E-06	) ÷ (	70	×	25,550	)
1,2-Dichloroethane	1.22E-08	= (	3600	×	0.0367	×	1.00E-01	×	250	×	6.6	×	1E-06	) ÷ (	70	×	25,550	)

See Table 45 for definitions and sources of equation variables identified as follows:

IF = intake factor
CF = conversion factor
SA = skin surface area available for contact
AF = soil to skin adherence factor
ABS = absorption factor
EF = exposure frequency
ED = exposure duration
BW = body weight
AT = averaging time

TABLE G8
INHALATION-SPECIFIC INTAKE FACTOR
CENTRAL TENDENCY EXPOSURE
SITE WORKER EXPOSURE: INHALATION OF AIRBORNE CHEMICALS FROM SOIL
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

EQUATION UNITS	IFinh	=	(	IR	×	EF	×	ED	×	1	/	PEF	+	1	/	VF	)	÷	(	BW	×	AT	)
	kg/kg-day			m^3/day		days/yr		yr				m^3/kg				m^3/kg				kg		days	
NONCARCINOGENIC EFFECTS																							
Arsenic	8.38E-11	=	(	11.3	×	250	×	6.6	×	1	/	1.32E+09	+	1	/	N/A	)	÷	(	70	×	2,409	)
Aldrin	8.38E-11	=	(	11.3	×	250	×	6.6	×	1	/	1.32E+09	+	1	/	N/A	)	÷	(	70	×	2,409	)
Dieldrin	8.38E-11	=	(	11.3	×	250	×	6.6	×	1	/	1.32E+09	+	1	/	N/A	)	÷	(	70	×	2,409	)
Heptachlor	8.38E-11	=	(	11.3	×	250	×	6.6	×	1	/	1.32E+09	+	1	/	N/A	)	÷	(	70	×	2,409	)
Methoxychlor	8.38E-11	=	(	11.3	×	250	×	6.6	×	1	/	1.32E+09	+	1	/	N/A	)	÷	(	70	×	2,409	)
3,4-Dichloroaniline	8.38E-11	=	(	11.3	×	250	×	6.6	×	1	/	1.32E+09	+	1	/	N/A	)	÷	(	70	×	2,409	)
Dinoseb	8.38E-11	=	(	11.3	×	250	×	6.6	×	1	/	1.32E+09	+	1	/	N/A	)	÷	(	70	×	2,409	)
Propanil	8.38E-11	=	(	11.3	×	250	×	6.6	×	1	/	1.32E+09	+	1	/	N/A	)	÷	(	70	×	2,409	)
Toxaphene	8.38E-11	=	(	11.3	×	250	×	6.6	×	1	/	1.32E+09	+	1	/	N/A	)	÷	(	70	×	2,409	)
1,2-Dichloroethane	5.27E-05	=	(	11.3	×	250	×	6.6	×	1	/	1.32E+09	+	1	/	2.10E+03	)	÷	(	70	×	2,409	)
CARCINOGENIC EFFECTS																							
Arsenic	7.90E-12	=	(	11.3	×	250	×	6.6	×	1	/	1.32E+09	+	1	/	N/A	)	÷	(	70	×	25,550	)
Aldrin	7.90E-12	=	(	11.3	×	250	×	6.6	×	1	/	1.32E+09	+	1	/	N/A	)	÷	(	70	×	25,550	)
Dieldrin	7.90E-12	=	(	11.3	×	250	×	6.6	×	1	/	1.32E+09	+	1	/	N/A	)	÷	(	70	×	25,550	)
Heptachlor	7.90E-12	=	(	11.3	×	250	×	6.6	×	1	/	1.32E+09	+	1	/	N/A	)	÷	(	70	×	25,550	)
Methoxychlor	7.90E-12	=	(	11.3	×	250	×	6.6	×	1	/	1.32E+09	+	1	/	N/A	)	÷	(	70	×	25,550	)
3,4-Dichloroaniline	7.90E-12	=	(	11.3	×	250	×	6.6	×	1	/	1.32E+09	+	1	/	N/A	)	÷	(	70	×	25,550	)
Dinoseb	7.90E-12	=	(	11.3	×	250	×	6.6	×	1	/	1.32E+09	+	1	/	N/A	)	÷	(	70	×	25,550	)
Propanil	7.90E-12	=	(	11.3	×	250	×	6.6	×	1	/	1.32E+09	+	1	/	N/A	)	÷	(	70	×	25,550	)
Toxaphene	7.90E-12	=	(	11.3	×	250	×	6.6	×	1	/	1.32E+09	+	1	/	N/A	)	÷	(	70	×	25,550	)
1,2-Dichloroethane	4.96E-06	=	(	11.3	×	250	×	6.6	×	1	/	1.32E+09	+	1	/	2.10E+03	)	÷	(	70	×	25,550	)

See Table 45 for definitions and sources of equation variables identified as follows:
IF = Intake factor
IR = Inhalation Rate
EF = Exposure frequency
ED = Exposure duration
ET = Exposure time

TABLE G9
INGESTION-SPECIFIC INTAKE FACTOR
CENTRAL TENDENCY EXPOSURE
TRESPASSER EXPOSURE: INGESTION OF CHEMICALS IN SOIL AND DUST
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

EQUATION	IF oral	=	(	IR	×	EF	×	ED	×	FI	×	CF	)	÷	(	BW	×	AT	)
UNITS	kg/kg-day			mg/day		days/yr		yr		Unitless		kg/mg				kg		days	
NONCARCINOGENIC	7.91E-09	=	(	50	×	26	×	10	×	0.1	×	1.00E-06	)	÷	(	45	×	3,650	)
CARCINOGENIC	1.13E-09	=	(	50	×	26	×	10	×	0.1	×	1.00E-06	)	÷	(	45	×	25,550	)

See table 49 for definitions and sources of equation variables identified as follows:

IF = intake factor
AT = averaging time
BW = body weight
FI = fraction ingested

IR = ingestion rate
EF = exposure frequency
ED = exposure duration
CF = conversion factor

TABLE G10
DERMAL-SPECIFIC INTAKE FACTOR
CENTRAL TENDENCY EXPOSURE
TRESPASSER EXPOSURE: DERMAL CONTACT WITH CHEMICALS IN SOIL
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

EQUATION	IF derm	= (	SA	×	AF	×	ABS	×	EF	×	ED	×	CF	) ÷ (	BW	×	AT	)
UNITS	kg/kg-day		cm^2/event		mg/cm^2		unitless		events/year		years		kg/mg		kg		days	
NONCARCINOGENIC																		
Arsenic	6.27E-09	= (	3.6E+03	×	3.67E-02	×	3E-02	×	26	×	10	×	1E-06	) ÷ (	45	×	3,650	)
Dieldrin	2.09E-08	= (	3.6E+03	×	3.67E-02	×	1E-01	×	26	×	10	×	1E-06	) ÷ (	45	×	3,650	)
1,2-Dichloroethane	2.09E-08	= (	3.6E+03	×	3.67E-02	×	1E-01	×	26	×	10	×	1E-06	) ÷ (	45	×	3,650	)
Heptachlor	2.09E-08	= (	3.6E+03	×	3.67E-02	×	1E-01	×	26	×	10	×	1E-06	) ÷ (	45	×	3,650	)
Methoxychlor	2.09E-08	= (	3.6E+03	×	3.67E-02	×	1E-01	×	26	×	10	×	1E-06	) ÷ (	45	×	3,650	)
3,4-Dichloroaniline	2.09E-08	= (	3.6E+03	×	3.67E-02	×	1E-01	×	26	×	10	×	1E-06	) ÷ (	45	×	3,650	)
Dinoseb	2.09E-08	= (	3.6E+03	×	3.67E-02	×	1E-01	×	26	×	10	×	1E-06	) ÷ (	45	×	3,650	)
Propanil	2.09E-08	= (	3.6E+03	×	3.67E-02	×	1E-01	×	26	×	10	×	1E-06	) ÷ (	45	×	3,650	)
Toxaphene	2.09E-08	= (	3.6E+03	×	3.67E-02	×	1E-01	×	26	×	10	×	1E-06	) ÷ (	45	×	3,650	)
1,2-Dichloroethane	2.09E-08	= (	3.6E+03	×	3.67E-02	×	1E-01	×	26	×	10	×	1E-06	) ÷ (	45	×	3,650	)
CARCINOGENIC																		
Arsenic	8.96E-10	= (	3.6E+03	×	3.67E-02	×	3E-02	×	26	×	10	×	1E-06	) ÷ (	45	×	25,550	)
Dieldrin	2.99E-09	= (	3.6E+03	×	3.67E-02	×	1E-01	×	26	×	10	×	1E-06	) ÷ (	45	×	25,550	)
1,2-Dichloroethane	2.99E-09	= (	3.6E+03	×	3.67E-02	×	1E-01	×	26	×	10	×	1E-06	) ÷ (	45	×	25,550	)
Heptachlor	2.99E-09	= (	3.6E+03	×	3.67E-02	×	1E-01	×	26	×	10	×	1E-06	) ÷ (	45	×	25,550	)
Methoxychlor	2.99E-09	= (	3.6E+03	×	3.67E-02	×	1E-01	×	26	×	10	×	1E-06	) ÷ (	45	×	25,550	)
3,4-Dichloroaniline	2.99E-09	= (	3.6E+03	×	3.67E-02	×	1E-01	×	26	×	10	×	1E-06	) ÷ (	45	×	25,550	)
Dinoseb	2.99E-09	= (	3.6E+03	×	3.67E-02	×	1E-01	×	26	×	10	×	1E-06	) ÷ (	45	×	25,550	)
Propanil	2.99E-09	= (	3.6E+03	×	3.67E-02	×	1E-01	×	26	×	10	×	1E-06	) ÷ (	45	×	25,550	)
Toxaphene	2.99E-09	= (	3.6E+03	×	3.67E-02	×	1E-01	×	26	×	10	×	1E-06	) ÷ (	45	×	25,550	)
1,2-Dichloroethane	2.99E-09	= (	3.6E+03	×	3.67E-02	×	1E-01	×	26	×	10	×	1E-06	) ÷ (	45	×	25,550	)

See Table 49 for definitions and sources of equation variables identified as follows:

IF = intake factor
CF = conversion factor
SA = skin surface area available for contact
AF = soil to skin adherence factor

ABS = absorption factor
EF = exposure frequency
ED = exposure duration
BW = body weight
AT = averaging time

TABLE G11
INHALATION-SPECIFIC INTAKE FACTOR
CENTRAL TENDENCY EXPOSURE
TRESPASSER EXPOSURE: INHALATION OF AIRBORNE CHEMICALS FROM SOIL
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

EQUATION	IFinh	= (	Inh R	×	EF	×	ED	× 1 /	PEF	+ 1 /	VF	) ÷ (	BW	×	AT	)
UNITS	kg/kg-day		m^3/day		days/yr		yr		m^3/kg		m^3/kg		kg		days	
NONCARCINOGENIC EFFECTS																
Arsenic	8.71E-12	= (	11.3	×	26	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	3,650	)
Aldrin	8.71E-12	= (	11.3	×	26	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	3,650	)
Dieldrin	8.71E-12	= (	11.3	×	26	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	3,650	)
Heptachlor	8.71E-12	= (	11.3	×	26	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	3,650	)
Methoxychlor	8.71E-12	= (	11.3	×	26	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	3,650	)
3,4-Dichloroaniline	8.71E-12	= (	11.3	×	26	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	3,650	)
Dinoseb	8.71E-12	= (	11.3	×	26	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	3,650	)
Propanil	8.71E-12	= (	11.3	×	26	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	3,650	)
Toxaphene	8.71E-12	= (	11.3	×	26	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	3,650	)
1,2-Dichloroethane	5.48E-06	= (	11.3	×	26	×	10	× 1 /	1.32E+09	+ 1 /	2.10E+03	) ÷ (	70	×	3,650	)
CARCINOGENIC EFFECTS																
Arsenic	1.24E-12	= (	11.3	×	26	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	25,550	)
Aldrin	1.24E-12	= (	11.3	×	26	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	25,550	)
Dieldrin	1.24E-12	= (	11.3	×	26	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	25,550	)
Heptachlor	1.24E-12	= (	11.3	×	26	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	25,550	)
Methoxychlor	1.24E-12	= (	11.3	×	26	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	25,550	)
3,4-Dichloroaniline	1.24E-12	= (	11.3	×	26	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	25,550	)
Dinoseb	1.24E-12	= (	11.3	×	26	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	25,550	)
Propanil	1.24E-12	= (	11.3	×	26	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	25,550	)
Toxaphene	1.24E-12	= (	11.3	×	26	×	10	× 1 /	1.32E+09	+ 1 /	N/A	) ÷ (	70	×	25,550	)
1,2-Dichloroethane	7.82E-07	= (	11.3	×	26	×	10	× 1 /	1.32E+09	+ 1 /	2.10E+03	) ÷ (	70	×	25,550	)

See Table 49 for definitions and sources of equation variables identified as follows:

IF = Intake factor
IR = Inhalation Rate
EF = Exposure frequency
ED = Exposure duration
ET = Exposure time
PEF = Particulate Emission Factor
VF= Volatilization Factor

TABLE G12
INHALATION-SPECIFIC INTAKE FACTOR
CENTRAL TENDENCY EXPOSURE
OFFSITE AGRICULTURAL WORKER EXPOSURE: INHALATION OF AIRBORNE (VAPOR PHASE) CHEMICALS FROM GROUNDWATER
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

EQUATION	IFinh	=	(	IR	×	EF	×	ED	×	ET	)	÷	(	BW	×	AT	)
UNITS	m^3/kg-day			m^3/hour		days/yr		yr		hr/day				kg		days	
NONCARCINOGENIC EFFECTS	2.90E-03	=	(	0.83	×	44.6	×	25	×	2	)	÷	(	70	×	9,125	)
CARCINOGENIC EFFECTS	1.03E-03	=	(	0.83	×	44.6	×	25	×	2	)	÷	(	70	×	25,550	)

See Table 56 for definitions and sources of equation variables identified as follows:

IF = Intake factor

IR = Inhalation Rate

EF = Exposure frequency

ED = Exposure duration

ET = Exposure time

BW = Body weight

AT = Averaging time

TABLE G13
VALUES USED FOR DAILY INTAKE CALCULATIONS
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Surface Soil
Exposure Point: Site 4
Receptor Population: Site Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT[a] Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	IR-S	Ingestion Rate of Soil	mg/day	50	U.S. EPA, 1989	-	-	CDI ing = (IR)(CF)(FI)(EF)(ED) / (BW)(AT)
	EF	Exposure Frequency	days/year	93.75[b]	Conservative assumption	-	-	
	ED	Exposure Duration	years	25	U.S. EPA, 1989	-	-	
	FI	Fraction ingested from contaminated source	unitless	1	Conservative assumption	-	-	
	CF	Conversion Factor	kg/mg	1.00E-06	SI system	-	-	
	BW	Body Weight	kg	70	U.S. EPA, 1989	-	-	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, 1989	-	-	
	AT-N	Averaging Time (Noncancer)	days	9,125	U.S. EPA, 1989	-	-	
Inhalation	InR-S	Inhalation Rate of Soil	m^3/day	20	U.S. EPA, 1989	-	-	CDI inh = (IR)(EF)(ED)[(1/VF)+(1/PEF)] / (BW)(AT)
	EF	Exposure Frequency	days/year	93.75b	Conservative assumption	-	-	
	ED	Exposure Duration	years	25	U.S. EPA, 1989	-	-	
	BW	Body Weight	kg	70	U.S. EPA, 1989	-	-	
	AT-C	Averaging Time (Cancer)	days	25550	U.S. EPA, 1989	-	-	
	AT-N	Averaging Time (Noncancer)	days	9125	U.S. EPA, 1989	-	-	
	PEF	Particulate Emission Factor	m^3/kg	1.32E+09	U.S. EPA, 1996	-	-	
	VF	Volatilization Factor	m^3/kg	Chemical specific	U.S. EPA, 1998	-	-	
Dermal	EF	Exposure Frequency	days/year	93.75b	Conservative assumption	-	-	CDI derm = (CF)(SA)(AF)(ABSd)(EF)(ED) / (BW)(AT)
	ED	Exposure Duration	years	25	U.S. EPA, 1989	-	-	
	CF	Conversion Factor	kg/mg	1.00E-06	SI system	-	-	
	SA	Skin Surface Area Available for Contact	cm^2	4,100	U.S. EPA, 1997	-	-	
	ABSd	Dermal Absorption Factor	unitless	Chemical specific	U.S. EPA, 1998	-	-	
	AF	Soil to Skil Adherence Factor	mg/cm^2/event	1	U.S. EPA, 1995	-	-	
	AT-C	Averaging Time (Cancer)	days	25,550	U.S. EPA, 1989	-	-	
	AT-N	Averaging Time (Noncancer)	days	9,125	U.S. EPA, 1989	-	-	

RME = Reasonable Maximum Exposure
CT = Central Tendency
mg = milligram
kg = kilogram
m^3 = cubic meters
cm^2 = square centimeters

a = The central tendency exposure was not evaluated for this site.
b = This exposure frequency assumes the site worker is present at this site 3 hours per day rather than 8 hours per day: (0.375 × 250 days year = 93.75 days/year).

U.S. EPA. 1989. Risk Assessment Guidance for Superfund - Volume I: Human Health Evaluation Manual (Part A) Interim Final. (EPA/540/1/89/002). Washington, DC. Office of Emergency and Remedial Response.
U.S. EPA. 1997. Exposure Factors Handbook. Washington, DC. Office of Emergency and Remedial Response.
U.S. EPA. 1996. *Soil Screening Guidance: User's Guide. 2nd Edition.* Washington, DC. Office of Solid Waste and Emergency Response. (Publication 9355.4-23).
U.S. EPA. 1998. EPA Region 6 Human Health Medium-Specific Screening Levels. October.
U.S. EPA. 1995. EPA Region 4: Supplemental Guidance to RAGS: Bulletin 3. Exposure Assessment. Atlanta, GA. Office of Health Assessment - Waste Management Division.

TABLE G14
INGESTION-SPECIFIC INTAKE FACTOR
SITE WORKER EXPOSURE: INGESTION OF CHEMICALS IN SOIL
SITE 4
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

EQUATION UNITS	IF oral kg/kg-day	= (	IR mg/day	×	EF days/yr	×	ED yr	×	FI unitless	×	CF kg/mg	) ÷ (	BW kg	×	AT days	)
NONCARCINOGENIC	1.83E-07	= (	50	×	93.75	×	25	×	1	×	1.00E-06	) ÷ (	70	×	9,125	)
CARCINOGENIC	6.55E-08	= (	50	×	93.75	×	25	×	1	×	1.00E-06	) ÷ (	70	×	25,550	)

See Table G13 for definitions and sources of equation variables identified as follows:

IF = intake factor
AT = averaging time
BW = body weight
FI = fraction ingested
IR = ingestion rate
EF = exposure frequency
ED = exposure duration
CF = conversion factor

TABLE G15
DERMAL-SPECIFIC INTAKE FACTOR
SITE WORKER EXPOSURE: DERMAL CONTACT WITH CHEMICALS IN SOIL
SITE 4
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

EQUATION UNITS	IF derm	=	(	SA	×	AF	×	ABS	×	EF	×	ED	×	CF	)	÷	(	BW	×	AT	)
	kg/kg-day			cm^2/event		mg/cm^2		unitless		events/year		years		kg/mg				kg		days	
NONCARCINOGENIC																					
Dieldrin	1.50E-06	=	(	4.10E+03	×	1	×	1.00E-01	×	93.75	×	25	×	1.00E-06	)	÷	(	70	×	9,125	)
Dinoseb	1.50E-06	=	(	4.10E+03	×	1	×	1.00E-01	×	93.75	×	25	×	1.00E-06	)	÷	(	70	×	9,125	)
CARCINOGENIC																					
Dieldrin	5.37E-07	=	(	4.10E+03	×	1	×	1.00E-01	×	93.75	×	25	×	1.00E-06	)	÷	(	70	×	25,550	)
Dinoseb	5.37E-07	=	(	4.10E+03	×	1	×	1.00E-01	×	93.75	×	25	×	1.00E-06	)	÷	(	70	×	25,550	)

See Table G13 for definitions and sources of equation variables identified as follows:

IF = intake factor
CF = conversion factor
SA = skin surface area available for contact
AF = soil to skin adherence factor
ABS = absorption factor
EF = exposure frequency
ED = exposure duration
BW = body weight
AT = averaging time

TABLE G16
INHALATION-SPECIFIC INTAKE FACTOR
SITE WORKER EXPOSURE: INHALATION OF AIRBORNE CHEMICALS FROM SOIL
SITE 4
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

EQUATION UNITS	IFinh	=	(	IR	×	EF	×	ED	×	1	/	PEF	+ 1 /	VF	)	÷	(	BW	×	AT	)
	kg/kg-day			m^3/day		days/yr		yr				m^3/kg		m^3/kg				kg		days	
NONCARCINOGENIC EFFECTS																					
Dieldrin	5.56E-11	=	(	20	×	93.75	×	25	×	1	/	1.32E+09	+ 1 /	N/A	)	÷	(	70	×	9,125	)
Dinoseb	5.56E-11	=	(	20	×	93.75	×	25	×	1	/	1.32E+09	+ 1 /	N/A	)	÷	(	70	×	9,125	)
CARCINOGENIC EFFECTS																					
Dieldrin	1.99E-11	=	(	20	×	93.75	×	25	×	1	/	1.32E+09	+ 1 /	N/A	)	÷	(	70	×	25,550	)
Dinoseb	1.99E-11	=	(	20	×	93.75	×	25	×	1	/	1.32E+09	+ 1 /	N/A	)	÷	(	70	×	25,550	)

See Table G13 for definitions and sources of equation variables identified as follows:

IF = Intake factor
IR = Inhalation Rate
EF = Exposure frequency
ED = Exposure duration
PEF = Particulate emission factor
VF = Volatilization factor
BW = Body weight
AT = Averaging time

G

Appendix J

Construction Worker Risk Evaluation

TABLE J1
INGESTION-SPECIFIC INTAKE FACTOR
CENTRAL TENDENCY EXPOSURE INGESTION RATE EVALUATION
CONSTRUCTION WORKER EXPOSURE: INGESTION OF CHEMICALS IN SOIL AND DUST
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

	IF oral	=	(	IR	×	EF	×	ED	×	FI	×	CF	)	÷	(	BW	×	AT	)
EQUATION	**IF oral**	**=**	**(**	**IR**	**×**	**EF**	**×**	**ED**	**×**	**FI**	**×**	**CF**	**)**	**÷**	**(**	**BW**	**×**	**AT**	**)**
UNITS	**kg/kg-day**			**mg/day**		**days/yr**		**yr**		**Unitless**		**kg/mg**				**kg**		**days**	
NONCARCINOGENIC	3.91E-08	=	(	50	×	20	×	1	×	1	×	1E-06	)	÷	(	70	×	365	)
	5.87E-08	=	(	75	×	20	×	1	×	1	×	1E-06	)	÷	(	70	×	365	)
	7.83E-08	=	(	100	×	20	×	1	×	1	×	1E-06	)	÷	(	70	×	365	)
	1.88E-07	=	(	240	×	20	×	1	×	1	×	1E-06	)	÷	(	70	×	365	)

Except for ingestion rate values, see Table 35 for definitions and sources of equation variables for pathway-specific intake factor calculations.

Because the construction worker ingestion rate evaluation does not include sites with carcinogenic COCs, the carcinogenic intake factor is not presented.

IF = intake factor
AT = averaging time
BW = body weight
FI = fraction ingested

IR = ingestion rate
EF = exposure frequency
ED = exposure duration
CF = conversion factor

TABLE J2
CALCULATION OF NON-CANCER HAZARDS
CENTRAL TENDENCY EXPOSURE INGESTION RATE EVALUATION
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Subsurface Soil
Exposure Point:	Site 3 Subsurface Soil
Receptor Population:	Construction Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Intake (Non-Cancer) (kg/kg-day)				Reference Dose	Hazard Quotient			
		mg/kg	50 mg/day	75 mg/day	100 mg/day	240 mg/day	mg/kg-day	50 mg/day	75 mg/day	100 mg/day	240 mg/day
Ingestion	Dinoseb	2,784	3.91E-08	5.87E-08	7.83E-08	1.88E-07	1E-03	0.11	0.16	0.22	0.52
Dermal	Dinoseb	2,784	1.03E-08	N/A	N/A	N/A	5E-04	0.057	0.057	0.057	0.057
								<1	<1	<1	<1

Except for ingestion rate values, see Table 35 for definitions and sources of equation variables for pathway-specific intake factor calculations.

Because none of the COCs have inhalation toxicity values and are not classified as carcinogens, the inhalation pathway and carcinogenic risk are not presented.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable

TABLE J3
CALCULATION OF NON-CANCER HAZARDS
CENTRAL TENDENCY EXPOSURE INGESTION RATE EVALUATION
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Subsurface Soil
Exposure Point:	Site 4 Subsurface Soil
Receptor Population:	Construction Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Intake (Non-Cancer) (kg/kg-day)				Reference Dose	Hazard Quotient			
		mg/kg	50 mg/day	75 mg/day	100 mg/day	240 mg/day	mg/kg-day	50 mg/day	75 mg/day	100 mg/day	240 mg/day
Ingestion	3,4- Dichloroaniline	1667	3.91E-08	5.87E-08	7.83E-08	1.88E-07	4E-03	0.016	0.024	0.033	0.078
	Dinoseb	244	3.91E-08	5.87E-08	7.83E-08	1.88E-07	1E-03	0.010	0.014	0.019	0.046
Dermal	3,4- Dichloroaniline	12000	1.03E-08	N/A	N/A	N/A	2E-03	0.062	0.062	0.062	0.062
	Dinoseb	244	1.03E-08	N/A	N/A	N/A	5E-04	0.005	0.005	0.005	0.005
								<1	<1	<1	<1

Except for ingestion rate values, see Table 35 for definitions and sources of equation variables for pathway-specific intake factor calculations.

Because none of the COCs have inhalation toxicity values and are not classified as carcinogens, the inhalation pathway and carcinogenic risk are not presented.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable

TABLE J4
CALCULATION OF NON-CANCER HAZARDS
CENTRAL TENDENCY EXPOSURE INGESTION RATE EVALUATION
CEDAR CHEMICAL CORPORATION, WEST HELENA, ARKANSAS

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Surface and Subsurface Soil
Exposure Point:	Site 9 Subsurface Soil
Receptor Population:	Construction Worker
Receptor Age:	Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Intake (Non-Cancer) (kg/kg-day)				Reference Dose	Hazard Quotient			
		mg/kg	50 mg/day	75 mg/day	100 mg/day	240 mg/day	mg/kg-day	50 mg/day	75 mg/day	100 mg/day	240 mg/day
Ingestion	3,4-Dichloroaniline	450	3.91E-08	5.87E-08	7.83E-08	1.88E-07	4E-03	0.004	0.007	0.009	0.021
	Dinoseb	5380	3.91E-08	5.87E-08	7.83E-08	1.88E-07	1E-03	0.211	0.316	0.421	1.011
	Propanil	445	3.91E-08	5.87E-08	7.83E-08	1.88E-07	5E-03	0.003	0.005	0.007	0.017
Dermal	3,4-Dichloroaniline	450	1.03E-08	N/A	N/A	N/A	2E-03	0.002	0.002	0.002	0.002
	Dinoseb	5380	1.03E-08	N/A	N/A	N/A	5E-04	0.111	0.111	0.111	0.111
	Propanil	445	1.03E-08	N/A	N/A	N/A	2.5E-03	0.002	0.002	0.002	0.002
								<1	<1	<1	1

Except for ingestion rate values, see Table 35 for definitions and sources of equation variables for pathway-specific intake factor calculations.

Because none of the COCs have inhalation toxicity values and are not classified as carcinogens, the inhalation pathway and carcinogenic risk are not presented.

EPC = Exposure point concentration
mg/kg = milligrams per kilogram
N/A = Not applicable

Appendix K

Ecological Checklist

CHECKLIST FOR ECOLOGICAL ASSESSMENT/SAMPLING

I. SITE DESCRIPTION

Date: **3/12/01**

1. Site Name: **Cedar Chemical Corp.**

   Location: **Highway 242 South**

   County: **Phillips** City: **West Helena** State: **AR**

2. What is the approximate area of the site? **48 acres**

3. Is this the first site visit? ☐ Yes **X No** If no, attach trip report of previous site visit(s) if available.

   Date(s) of previous site visit(s): Phase I 1992, Tech Memo 1993, Facility Investigation 1994, through 1996. Quarterly monitoring of wells 1995 through 1997.

4. Please attach USGS topographic map(s) of the site, if available. **See attachment.**

5. Are aerial or other site photographs available? ☐ Yes **X No**
   If yes, please attach any available photo(s) to the site map at the conclusion of this section.

6.

The land use on the site is:	The area surrounding the site is: (__1__ mile radius)
____% Urban	____% Urban
____% Rural	__5__% Rural
____% Residential	__5__% Residential
__100__% Industrial (☐ light **X** heavy)	__70__% Industrial (☐ light ☐ heavy)
____% Agricultural	__20__% Agricultural
(Crops:)	(Crops:)
____% Recreational (Describe; note if it is a park, etc.)	____% Recreational (Describe; note if it is a park, etc.)
____% Undisturbed	____% Undisturbed
____% Other:	____% Other:

7. Has any movement of soil taken place at the site? **X Yes** ☐ No If yes, please identify the most likely cause of this disturbance:

____ Agricultural Use	__X__ Heavy Equipment	____ Mining
__X__ Natural Events	__X__ Erosion	__X__ Other

Please describe:

The majority of soil movement that has taken place at the site was done closing out the old waste lagoons and improvements made to the storm water treatment system. Natural storm events, and equipment usage on site also contribute to soil movement.

8. Do any potentially sensitive environmental areas exist adjacent to or in proximity to the site, e.g., federal and state parks, national and state monuments, wetlands, prairie potholes, etc.? Describe. *Remember, flood plains and wetlands are not always obvious; do not answer "no" without confirming information.*

Yes, there is a wetland onsite.

8a. Please provide the source(s) of information used to identify these sensitive areas, and indicate their general location on the site map.

The wetland onsite was identified during the Facility Investigation and is presented in Figure 1.

9. What type of facility is located at the site?

X chemical ☐ manufacturing ☐ mixing ☐ waste disposal ☐ none

☐ other (specify):

10. What are the suspected contaminants of concern at the site? If known, what are the maximum concentration levels?

Pesticides, herbicides, chlorinated solvents, and metals. For site specific contaminants and concentrations see Facility Investigation June 28, 1996, or the Risk Assessment Revision 3 March 2001.

11. Check any potential routes of off-site migration of contaminants observed at the site:

☐ swales ☐ depressions ☐ drainage ditches

☐ runoff ☐ windblown particulates ☐ vehicular traffic

X other (specify) **All storm water and waste water is collected and treated in a waste water treatment system before it is released from the site. The treated water is discharged through a 7-mile pipeline into the Mississippi river.**

13. If known, what is the approximate depth to the water table? **11' to 29' depending where you are onsite.**

14. Is the direction of surface runoff apparent from site observation? **X Yes** ☐ No If yes, to which of the following does the surface runoff discharge? Indicate all that apply.

☐ surface water ☐ groundwater ☐ sewer **X collection impoundment**

15. Is there a navigable water body or tributary to a navigable water body? ☐ Yes **X No**

16. Is there a water body anywhere on or in the vicinity of the site? If yes, also complete Section III: Aquatic Habitat Checklist — Non-Flowing Systems and/or Section IV: Aquatic Habitat Checklist — Flowing Systems.

☐ Yes (approx. distance __________) ☐ No

17. Is there evidence of flooding? ☐ Yes **X No** *Wetlands and flood plains are not always obvious; do not answer "no" without confirming information.* If yes, complete Section V: Wetland Habitat Checklist.

18. If a field guide was used to aid any of the identifications, please provide a reference. Also, estimate the time spent identifying fauna. [Use the back of this page if additional space for text is needed.]
National Audubon Society and Peterson Field Guides were used for Flora and Fauna. An Approximately 2.5-hour field survey was conducted at the site.

19. Are any threatened and/or endangered species (plant or animal) known to inhabit the area of the site?
☐ Yes **X No** *If yes, it is required to verify this information with the U.S. Fish and Wildlife Service.*
If species' identity is known please list them below.
None of the three listed species that occur in Phillips Co. are present at the site. This was confirmed by the Arkansas Natural Heritage Commission, field survey, and observations made while working on the site over the past 5 years.

20. Weather conditions at the time this checklist was prepared.

68 Temperature (°C/°**F**) **95** Normal daily high temperature

SW 5mph Wind (Direction/Speed) ______ Precipitation (rain, snow)

______ Cloud cover

IA. SUMMARY OF OBSERVATIONS AND SITE SETTING

Completed by: **EnSafe Inc.**

Additional Preparers:

Date: **3/12/01**

II. TERRESTRIAL HABITAT CHECKLIST

IIA. WOODED

1. Are there any wooded areas at the site? ☐ Yes **X No** If no, go to Section B: Shrub/Scrub.

2. What percentage or area of the site is wooded? ___%(___ acres). Indicate the wooded area on the site map attached to a copy of this checklist. Please identify what information was used to determine the wooded area of the site.

3. What is the dominant type of vegetation in the wooded area? (Evergreen /Deciduous/ Mixed) Provide a photograph, if available. Dominant plant, if known:

4. What is the predominant size of the trees at the site? Use diameter at breast height.

☐ 0-6 in. ☐ 6-12 in. ☐ >12 in.

5. Specify type of understory present, if known. Provide a photograph, if available.

IIB. SHRUB/SCRUB

1. Is shrub/scrub vegetation present at the site? ☐Yes **X No** If no, go to Section C: Open Field.

2. What percentage of the site is covered by scrub/shrub vegetation? ____% (___ acres). Indicate the areas of shrub/scrub on the site map. Please identify what information was used to determine this area.

3. What is the dominant type of scrub/shrub vegetation, if known? Provide a photograph if available.

4. What is the approximate average height of the scrub/shrub vegetation?

   ☐ 0-2 ft. ☐ 2-5 ft. ☐ >5 ft.

5. Based on site observations, how dense is the scrub/shrub vegetation?

   ☐ dense ☐ patchy ☐ sparse

IIC. OPEN FIELD

1. Are there open (bare, barren) field areas present at the site? **X** Yes ☐ No If yes, please indicate the type below:

   ☐ prairie/plains ☐ savannah ☐ old field **X** other (specify): **Open field**

2. What percentage of the site is open field? **1** % (**2** acres). Indicate the open fields on the site map.

3. What is/are the dominant plant(s)? Provide a photograph, if available.
   Bermuda, Fescue, and Clover

4. What is the approximate average height of the dominant plant? **1.5"**

5. Describe the vegetation cover: ☐ dense ☐ sparse **X patchy**

IID. MISCELLANEOUS

1. Are other types of terrestrial habitats present at the site other than woods, scrub/shrub, and open field?
   ☐ Yes **X No** If yes, identify and describe them below.

2. Describe the terrestrial miscellaneous habitat(s) and identify these area(s) on the site map.

3. What observations, if any, were made at the site regarding the presence and/or absence of insects, fish, birds, mammals, etc.? **See species list.**

4. Review the questions in Section I to determine if any additional habitat checklists should be completed for this site.

III. AQUATIC HABITAT CHECKLIST — NON-FLOWING SYSTEMS

Note: *Aquatic systems are often associated with wetland habitats. Please refer to Section V, Wetland Habitat Checklist.*

1. What type of open-water, non-flowing system is present at the site?

☐ Natural (pond, lake)
☐ Man-made (lagoon, reservoir, canal, impoundment)

2. If known, what is the name(s) of the water body(ies) on or adjacent to the site?

3. If a water body is present, what are the known uses of it (e.g.: recreation, navigation, etc.)?

4. What is the approximate size of the water body(s)? 2 acre(s)

5. Is any aquatic vegetation present? ☐ Yes ☐ No If yes, please identify the type of vegetation present (if known).

☐ emergent ☐ submergent ☐ floating

6. If known, what is the depth of the water?

7. What is the general composition of the substrate? Check all that apply.

☐ Bedrock	☐ Sand (coarse)	☐ Muck (fine/black)
☐ Boulder (>10 in.)	☐ Silt (fine)	☐ Debris
☐ Cobble (2.5-10 in.)	☐ Marl (shells)	☐ Detritus
☐ Gravel (0.1-2.5 in.)	☐ Clay (slick)	☐ Concrete

☐ Other (specify): ____________________

8. What is the source of water in the water body?

☐ River/stream/creek	☐ Groundwater	☐ Industrial discharge
☐ Surface runoff	☐ Other (specify):____________________	

9. Is there a discharge from the site to the water body? ☐ Yes ☐ No If yes, please describe this discharge and its path.

10. Is there a discharge from the water body? ☐ Yes ☐ No If yes, and the information is available, identify from the list below the environment into which the water body discharges.

☐ River/stream/creek	☐ onsite	☐ offsite	Distance _____
☐ Groundwater	☐ onsite	☐ offsite	
☐ Wetland	☐ onsite	☐ offsite	Distance ____________________
☐ Impoundment	☐ onsite	☐ offsite	

11. Identify any field measurements and observations of water quality that were made. For those parameters for which data were collected provide the measurement and the units of measure below:

2 acres	Area
2 feet	Depth (average)
NA	Temperature (depth of the water at which the reading was taken ____)
NA	pH
NA	Dissolved oxygen
NA	Salinity
NA	Turbidity (clear, slightly turbid, turbid, opaque) (Secchi disk depth ____)
NA	Other (specify)

12. Describe observed color and area of coloration.

Water was clear with little or no turbidity.

13. Mark the open-water, non-flowing system on the site map which will be attached to this checklist.

14. What observations, if any, were made at the water body regarding the presence and/or absence of benthic macroinvertebrates, fish, birds, mammals, etc.?

IV. AQUATIC HABITAT CHECKLIST — FLOWING SYSTEMS

Note: *Aquatic systems are often associated with wetland habitats. Please refer to Section V, Wetland Habitat Checklist.*

1. What type(s) of flowing water system(s) is (are) present at the site?

☐ River ☐ Stream ☐ Creek
☐ Dry wash ☐ Arroyo ☐ Brook
☐ Man-Made (ditch, etc.) ☐ Intermittent Stream ☐ Channeling
☐ Other (specify): ______________________

2. If known, what is the name of the water body?

3. For natural systems, are there any indicators of physical alteration (e.g., channeling, debris, etc.)?
☐ Yes ☐ No If yes, please describe indicators that were observed.

4. What is the general composition of the substrate? Check all that apply.

☐ Bedrock ☐ Sand (coarse) ☐ Muck (fine/black)

☐ Boulder (> 10 in.) ☐ Silt (fine) ☐ Debris

☐ Cobble (2.5-10 in.) ☐ Marl (shells) ☐ Detritus

☐ Gravel (0.1-2.5 in.) ☐ Clay (slick) ☐ Concrete

☐ Other (specify) ______________________

5. What is the condition of the bank (e.g., height, slope, extent of vegetative cover)?

6. Is the system influenced by tides? ☐ Yes ☐ No What information was used to make this determination?

7. Is the flow intermittent? ☐ Yes ☐ No If yes, please note the information that was used in making this determination.

8. Is there a discharge from the site to the water body? ☐ Yes ☐ No If yes, please describe the discharge and its path.

9. Is there a discharge from the water body? ☐ Yes ☐ No If yes, and the information is available, please identify what the water body discharges to and whether the discharge is onsite or offsite.

10. Identify any field measurements and observations of water quality that were made. For those parameters for which data were collected provide the measurement and the units of measure in the appropriate space below:

_____ Width (ft.)

_____ Depth (ft.)

_____ Velocity (specify units: _____)

_____ Temperature (depth of the water at which the reading was taken _____)

_____ pH

_____ Dissolved oxygen

_____ Salinity

_____ Turbidity (clear, slightly turbid, turbid, opaque) (Secchi disk depth _____)

_____ Other (specify)

11. Describe observed color and area of coloration.

12. Is any aquatic vegetation present? ☐ Yes ☐ No If yes, please identify the type of vegetation present if known.

☐ emergent ☐ submergent ☐ floating

13. Mark the flowing water system on the attached site map.

14. What observations were made at the water body regarding the presence and/or absence of benthic macroinvertebrates, fish, birds, mammals, etc.?

V. WETLAND HABITAT CHECKLIST

1. Based on observations and/or available information, are designated or known wetlands definitely present at the site? **X Yes** ☐ No

   Please note the sources of observations and information used (e.g., USGS Topographic Maps, National Wetland Inventory, Federal or State Agency, etc.) to make this determination.

   Wetland survey conducted by EnSafe and conversation with USACOE Memphis District

2. Based on the location of the site (e.g., along a water body, in a floodplain, etc.), and site conditions (e.g., standing water; dark, wet soils; mud cracks; debris line; water marks), are wetland habitats suspected?

   X Yes ☐ No If yes, proceed with the remainder of the wetland habitat identification checklist.

3. What type(s) of vegetation are present in the wetland?

   X emergent **X submergent** **X floating** **X Wooded**

   ☐ Scrub/Shrub ☐ Other (specify) ______

4. Provide a general description of the vegetation present in and around the wetland (height, color, etc.) Provide a photograph of the known or suspected wetlands, if available.

   The dominant vegetation consists of black willow (Salix nigra), Chickasaw plum (Prunus angustifolia), Common cattail (Typha latifolia), floating primrose willow (Ludwgia spp.) and duckweed (Lemna spp.)

5. Is standing water present? **X Yes** ☐ No If yes, is this water: **X Fresh** ☐ Brackish
   What is the approximate area of the water (sq. ft.)? **2 acres**
   Please complete questions 4, 11, 12 in Checklist III — Aquatic Habitat — Non-Flowing Systems.

6. Is there evidence of flooding at the site? What observations were noted?

   ☐ Buttressing ☐ Water marks ☐ Mud cracks ☐ Debris line

   X Other (describe below) **There is no evidence of flooding at the site, however seasonal variations in water levels have been observed during field events over the past 5 years within the wetland.**

7. If known, what is the source of the water in the wetland?

☐ Stream/River/Creek/Lake/Pond ☐ Groundwater

☐ Flooding ☐ Surface Runoff

X Other (describe below) **Direct rain water**

8. Is there a discharge from the site to a known or suspected wetland? ☐ Yes **X No** If yes, please describe.

____

____

____

____

9. Is there a discharge from the wetland? ☐ Yes **X No** If yes, to what water body is discharge released?

☐ Surface stream/River ☐ Groundwater ☐ Lake/Pond ☐ Marine

10. If a soil sample was collected, describe the appearance of the soil in the wetland area. Circle or write in the best response. **No soil was collected from the wetland.**

Color (blue/gray, brown, black, mottled) ______________________________
Water content (dry, wet, saturated/unsaturated) ______________________________

11. Mark the observed wetland area(s) on the attached site map. **See Figure 1.**

EXPLANATION OF TERMS USED IN THIS CHECKLIST

Arroyo	Dry gulch, brook, or creek. A deep gully cut by an intermittent brook or stream.
Benthic	Pertaining to the bottom of a water body.
Detritus	Loose fragments or particles formed by the disintegration of rocks.
Marl	A mixture of clays, carbonates of calcium and magnesium and remnants of shells.
Riparian	Of, or on the bank of, a natural course of water.
Secchi (disk)	Basic measure of turbidity, visibility, or transparency of water.
Submergent Vegetation	Hidden, obscure vegetation which is inundated with water.
Swales	Low traces of land which are often moist or marshy.
Wet Weather Conveyance	Man-made or natural watercourses, including natural watercourses that have been modified by channelization, that flow only in direct response to precipitation runoff in their immediate locality and whose channels are above the groundwater table and which do not support fish or aquatic life, and are not suitable for drinking-water supplies.

Site Species List

The following list is comprised of species observed during the site survey, working at the site over the past five years and information obtained from interviews with workers at the site.

Reptiles
Southern Leopard Frog (*Rana sphenocephala*)
Bullfrog (*Rana catesbeiana*)

Trees
Black willow (*Salix nigra*)
Chickasaw plum (*Prunus angustifolia*)
Southern Red Oak (Quercus falcata)

Aquatics
Common cattails (*Typha latifolia*)
Floating primrose willow (*Ludwgia spp.*)
Duckweed (*Lemna spp.*)

Birds
Redtail Hawk (*Buteo jamaicensis*)
American Kestrel (*Falco sparverius*)
Mourning Dove (*Zenaida macroura*)
Common Grackle (*Quiscalus quiscula*)
Red-Winged Blackbird (Agelaius phoeniceus)
Purple Martin (Progene subis)

J

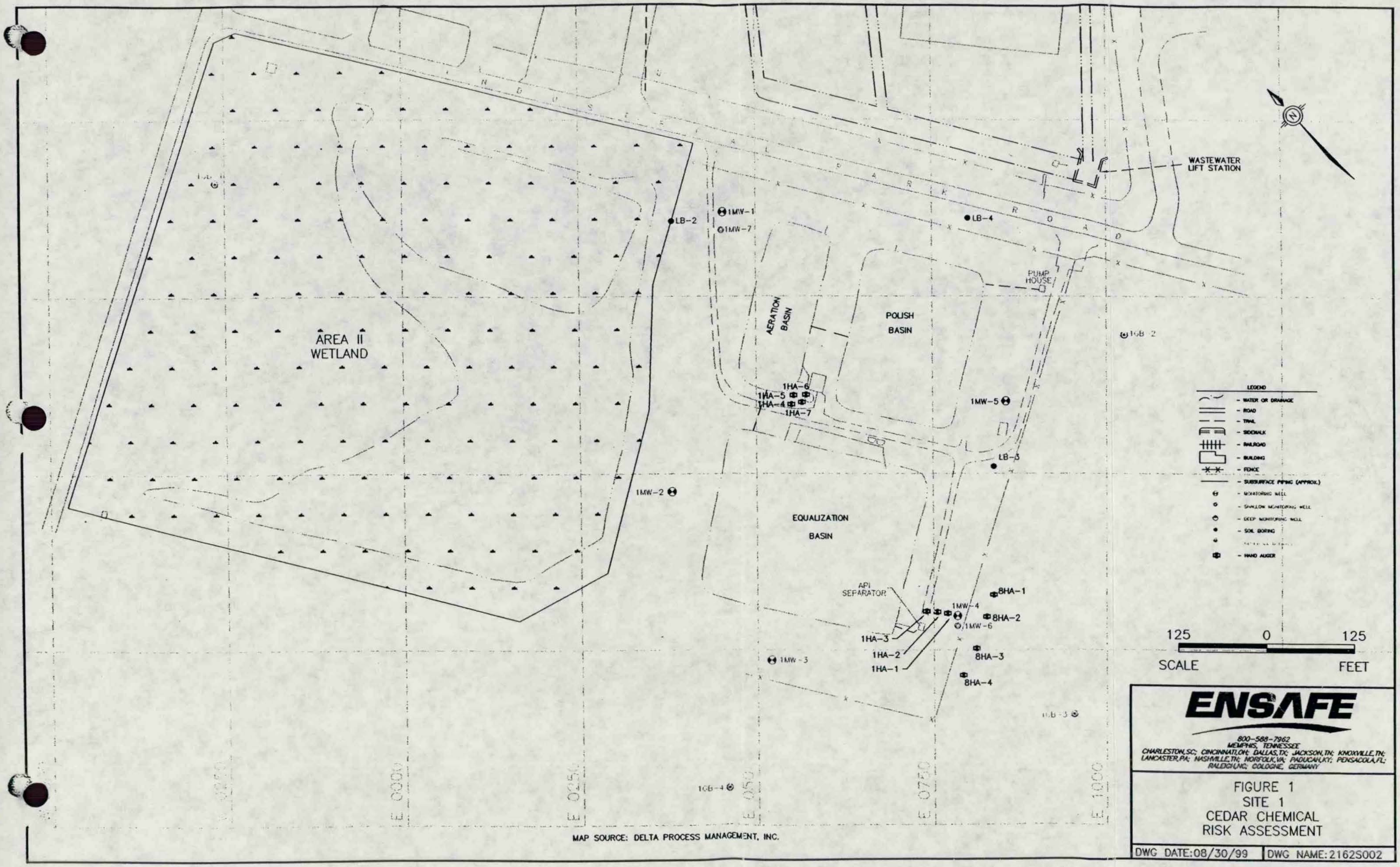


FIGURE 1
SITE 1
CEDAR CHEMICAL
RISK ASSESSMENT

Cedar Chemical
Wetland Photographs

Cedar Chemical
Wetland Photographs